

BUSINESS AND ECONOMICS PUBLICATIONS

WILLIAM HOMER SPENCER, *Editor*  
*Hobart W. Williams Distinguished Service*  
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MANAGEMENT PLANNING AND CONTROL

A Managerial Approach to Industrial Accounting

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# MANAGEMENT PLANNING AND CONTROL

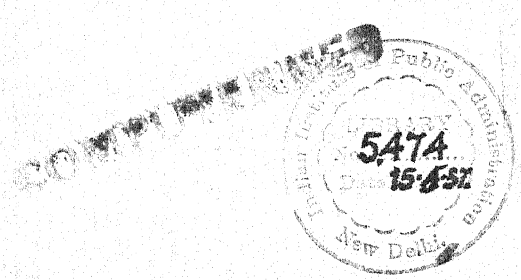
A Managerial Approach to Industrial  
Accounting

BY

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FIRST EDITION



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McGRAW-HILL BOOK COMPANY, INC.  
NEW YORK    TORONTO    LONDON • 1949

## MANAGEMENT PLANNING AND CONTROL

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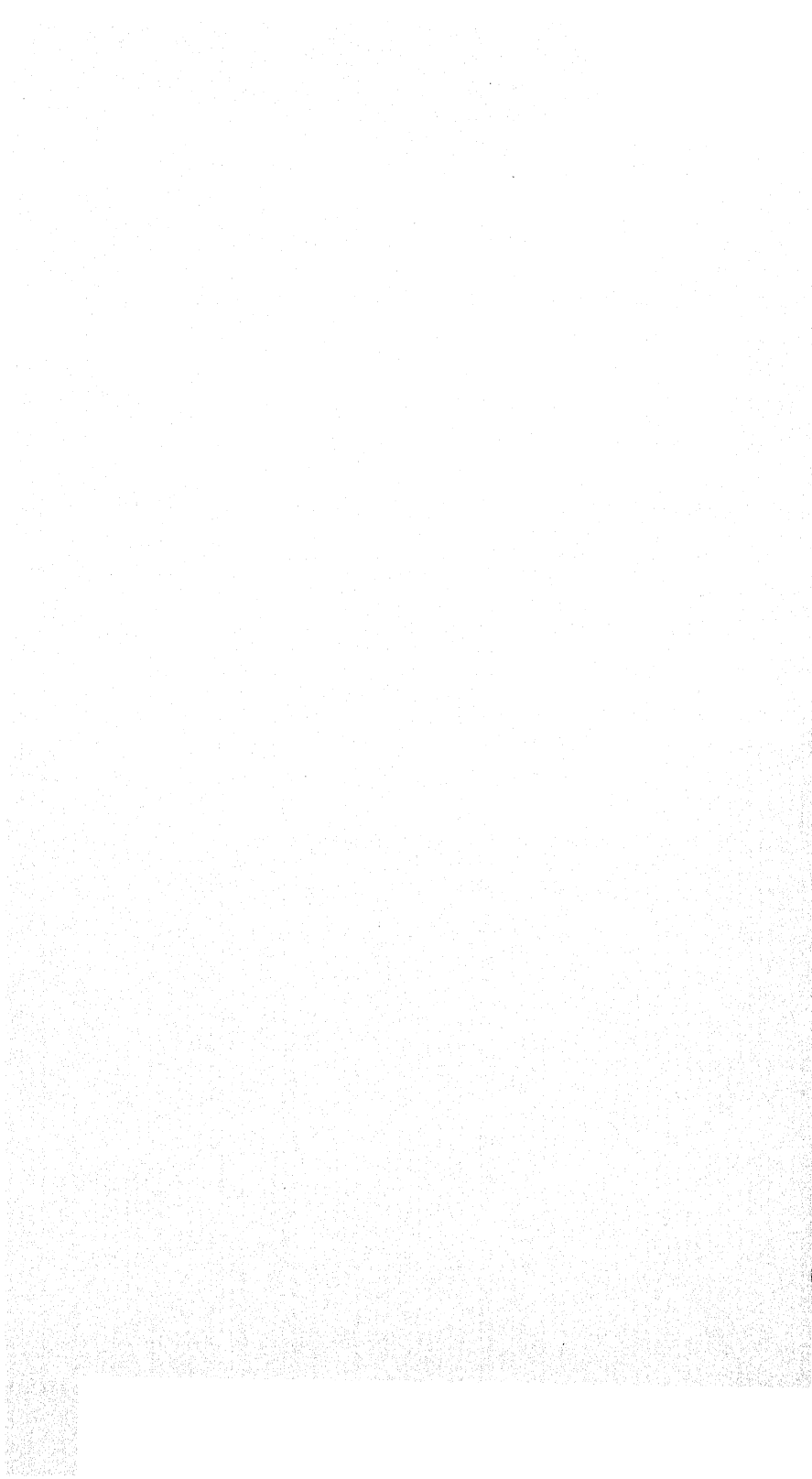
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Published by arrangement with  
the University of Chicago Press

*To*

E. O. S.

*in commemoration of the many adventures we  
shared, some of which are reported in this book*



## PREFACE

This book is an attempt to tell managements and accountants how accounting, and more especially cost accounting, should be changed so as to produce data of greater value to management. It also attempts to tell managements how to use such data in planning and controlling enterprise operations. To these ends it necessarily contains more management than accounting. Its title, *Management Planning and Control*, may be a little too broad; its subtitle, *A Managerial Approach to Industrial Accounting*, is surely too restricted. Between the two, the volume is reasonably accurately described.

I assume the reader has reasonable familiarity with the content of introductory courses in economics, accounting, and management. Since collegiate and graduate schools of business and of industrial or management engineering require all students to take such courses early in the curriculum, this study is appropriate for the later years of such curriculums. I believe its pragmatic, operational approach will prove a welcome contrast to the more analytical and descriptive treatments of so many texts.

Many discussions with managers, industrial engineers, and business consultants convince me that such men constantly meet the kinds of problems analyzed in this study, and that such men will find much of interest and of value to them here. With this voluntary readership in mind, I have tried to make the book readable, interesting, challenging, and useful to those now charged with the solution of industry's problems as well as to those who aspire to such responsibilities. This is a book about accounting with virtually no numbers to impede a grasp of the philosophy presented. That is not to say that it is not practical. I have included much illustrative material drawn from more than a decade of consulting practice. Readers with managerial experience will recognize many of their own recurrent problems in those discussed in this volume. For readers needing a bit more economics or accounting or management theory, lists of selected reading materials follow each chapter.

This book has been in the making for twenty years. It has been written and rewritten, thrown away and started over. It has been revised several times to strengthen sections, to bring parts up to date,

and to include more case material as it became available. It is no longer possible to give credit to all to whom credit is due. Perhaps as much credit should be given to those whose advice resulted in omitting tangential materials as to those who have affected the material retained. There are some whose encouragement, help, and long-suffering patience have not been forgotten with the passage of years and the succession of addenda, omission, and alteration. Among these are Garfield Cox, S. H. Nerlove, and William Vatter, all of the University of Chicago, and William Norman Mitchell, formerly of the University of Chicago and now with A. T. Kearney and Associates. Other teachers whose help and encouragement are gratefully acknowledged are Leon Carroll Marshall, Henry Post Dutton, and William Homer Spencer. In industry, I owe most to Edson Oliver Sessions and James O. McKinsey and to many of their clients who provided an abundant variety of tough problems and searching criticism. My debt to the literature of the field is attested by footnotes throughout the book.

Here I must end my gesture of gratitude; space and records do not enable me to list all the teachers, colleagues, clients, and critics who have made this book different from what it would otherwise have been. Nor should it be necessary to remind readers that these good friends are not responsible for the way in which I have selected and interpreted their ideas and their counsel.

BILLY E. GOETZ

YELLOW SPRINGS, OHIO  
*March, 1949*

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## CHAPTER 1

### NATURE AND SCOPE OF PROBLEM

Purposes of the chapter: to tell what the study attempts to do, why it is worth doing, what the difficulties are, how the problem is approached, and where the study ends.

This study develops a logic and a method for an accounting designed to supply information needed by management. The approach is pragmatic and operational: what are management's problems, and how can management solve them? What data are needed by management in attacking these problems, and how can these data be obtained? What then are the objectives of the study, its limits, and why is it important?

#### OBJECTIVES OF STUDY

A managerial problem consists of a purpose in a situation. Different purposes or different situations impose different requirements as to classification and evaluation of data. This study analyzes managerial purposes and their settings to determine the classifications and evaluations relevant to each type of problem. It seeks to develop a method of accumulating data flexible enough to meet all managerial needs for accounting data. It seeks to develop an accounting theory and method consistent with managerial theory, which emphasizes purposes in situations, and with economic theory, which analyzes situations in which purposes operate.

#### *Managerial Uses of Accounting Data*

In devising methods of accumulating data, attention should be focused on ultimate managerial purposes. Records should not be kept to ascertain costs: costs should be ascertained to solve specific managerial problems. The first view regards costs as absolutes, as single-valued truths accessible to the bookkeeper. The second regards costs as relative, as true only within a given frame determined by a managerial problem, *i.e.*, by a purpose in a situation.

Management and consequently managerial accounting are concerned with the efficiency of an individual industrial enterprise. Management's search for economic efficiency may be analyzed into

three groups of activities: (1) planning enterprise activities, (2) controlling enterprise operations, (3) conducting social contacts.<sup>1</sup>

*Planning enterprise activities.* Managerial planning includes formulation of policies, design of organization, selection of resources, and establishment of techniques and procedures. Although policies are relatively general and permanent plans, they remain subject to reconsideration as conditions change. Most companies, for example, encounter streams of suggestions for new products, each of which requires a decision as to company policies. Manpower shortages and pressures from governmental agencies may cause changes in compensation policies. As companies expand and policies change, the pattern of organization must be adjusted to fit new conditions. An example is the almost universal development of priorities managers to cope with War Production Board regulations and their disappearance when the regulations were rescinded. As equipment grows old or becomes obsolete or inadequate, new equipment must be selected. Products and processes also become obsolete. Changing needs and new designs arising from technological progress render selection problems highly dynamic. With new policies and new equipment comes a need for new techniques and procedures. Thus development of tabulating equipment resulted in many changes in accounting techniques.

Planning, in this sense, is fundamentally choosing. What changes should be made? How can management tell when the time to change has arrived? A planning problem arises when an alternate possible course of action is discovered: *e.g.*, should an old delivery truck be repaired or replaced? The manager projects each alternate as a detailed program of future action, ascertains differences among these programs measured in terms of ultimate effects on enterprise profit, chooses the most attractive, and later reviews his choice to determine if a need for reconsideration exists. The accounting problem involved is one of ascertaining how the composition and importance of costs and incomes change as one program is substituted for another.

<sup>1</sup> Various writers have divided the functions of management differently. Among others are the following:

Taylor: planning, performance

Newman: policies, organization, facilities, techniques

Church: design, equipment, operation, control, coordination

Sheldon: selling, procuring, facilitating

Walker: planning, direction, control, representing

Gulick: planning, organizing, staffing, directing, coordinating, operating, reporting, budgeting

*Controlling operations.* Managerial control includes control of achievement, of costs, and of investments. Having selected a plan, management reformulates it in terms of individual responsibilities for carrying out each aspect of the plan. Individuals are made responsible for achieving definite ends within definite limitations as to costs and investments. For example, the sales manager is made responsible for securing a given volume of sales without exceeding certain limitations as to selling costs permitted him. He is further restricted as to investments in branch facilities, display fixtures, office equipment, etc.

Control consists of securing conformity to plans. Individual employees are the operational units by means of which managerial plans are brought to fruition. These individuals must be directed, motivated, inspected, and corrected. This involves establishment of standards in terms of individuals' responsibilities, communication of plans and standards to subordinates, compensation for performance, measurement of results in terms comparable to the statement of plans and standards, and remedial action wherever performance is found deficient as compared with plans. For example, individual sales quotas are set; commissions, prizes, or praise are given to obtain motivation; sales are recorded and classified by salesmen; and quotas and sales are compared. When sales are below quota, a remedy is sought and applied: the product may be redesigned, new types of customers may be sought, new sales aids developed, or the salesman may be retrained or replaced. The accounting problem concerns reclassification of plans and standards according to individual responsibilities, followed by accumulation of performance data classified and measured in comparable terms.

*Conducting social contacts.* Planning and performance both take place within a social matrix. Management must plan in terms of what the environment will permit or facilitate. Other economic and political units attempt to influence managerial plans. Among these units are governments, unions, competitors, sources of supply, and customers. And management, in turn, attempts to influence such other social units. Sometimes management must conform to their wishes, sometimes management can persuade other social units to act in certain ways, and sometimes management can afford to defy these other social units.

Often these other social units demand information about management's plans or enterprise operations, e.g., credit information, tax data, etc. Many such data are accumulated by the accounting system of the enterprise. The accounting problem is one of complying with imposed regulations as to classification and evaluation of data. Fre-

quently management voluntarily submits data in order to persuade other social units to conform to management's wishes. This situation usually permits greater freedom as to the nature and form of data presented.

### *The Method of Managerial Accounting*

This study has a pragmatic, operational approach. What are the objectives and problems of management? What are the characteristics of situations in which these problems occur? What obstacles must be overcome to attain managerial objectives? What resources or other aids are available in the situation? What data are needed by management to give management a clear picture of its problems and its opportunities? How can these data be quickly and economically obtained? There is the job of the managerial approach to accounting.

In common with all other enterprise activities, managerial accounting should be worth what it costs:

1. It should be directed toward objectives of sufficient importance to justify its costs.
2. It should be valid in terms of the environment within which management must operate.
3. It should have structure and logic to give it completeness and consistency.
4. It must be reducible to a reasonably simple method for economy and workability and to ensure provision of data before they have become obsolete and useless.

*Objectives.* Accounting is an expensive tool, of no value in itself. Its values are derived wholly from the importance of its objectives and its success in attaining these objectives. Its costs are determined by the methods employed, the records kept, and the reports rendered. These costs should be justified, method by method, record by record, and report by report, by the values of objectives attained. A study of managerial accounting should analyze the managerial objectives of accounting and justify principles and methods proposed by managerial values of data that such methods provide.

The managerial objectives of accounting are to provide data to help management plan and control operations. The accounting problem is one of selecting, classifying, and evaluating these data. The objectives are diverse and require different classifications and evaluations. Consequently, a flexible method is needed. Managerial planning requires data classified according to alternate possible courses of action. Managerial control requires data classified according to in-

dividual administrative responsibilities. Evaluation for managerial planning runs in terms of differences or increments of costs and incomes associated with programs to be compared. Evaluation for managerial control reflects the amenability of costs, incomes, and investments to control by designated individuals.

Classification and evaluation of data for legal-financial purposes associated with managerial representation of the enterprise follow still another pattern. The principles governing these data are largely imposed by the environment. Often management must conform to imposed requirements, or the environment becomes too hostile for the enterprise to survive. The imposed requirements are appropriate to social objectives rather than to enterprise or managerial objectives: to secure an equitable and definitive distribution of the tax burden, to implement social policies by setting controls and limits to private action, and to settle conflicts among private parties arising in enterprise operations. The imposed requirements seek to secure comparability between periods and among enterprises and to substitute objective historical fact for subjective managerial judgment.

*Environment.* Accounting can be useful to management only to the extent that its premises accurately reflect the enterprise's environment. If premises are oversimplified, data compiled become too laden with error to be valuable or too encumbered with qualifications and exceptions to be usable. If too detailed and elaborate, the method becomes too slow, cumbersome, and expensive to use. A nice balance must be maintained between the true and the useably simple. This is a shifting balance. As techniques and mechanical aids improve, greater detail becomes possible and premises can more accurately reflect the environment.

Managerial accounting must make peace with management's environment. The nature of physical and financial costs and incomes should be explored. In general, such costs and incomes are not proportional to time or to output. Some are relatively fixed, some relatively variable, and they shift from fixed toward variable as the period contemplated increases. The environment imposes discontinuities and curvilinear relationships that managerial accounting must recognize or lose relevancy. Economic theory concepts of incremental revenues and costs and of opportunity costs supply the basis for classifications and evaluations of data appropriate to managerial accounting.

*Logic.* The theory of managerial accounting should be consistent with managerial and economic theory. The three have much in

common. Management directs economic activity within an economic order toward economic ends. Economics is largely a study of activities, logic, and motives of manager-entrepreneurs in terms of their social consequences. Accounting is a managerial tool reflecting economic relationships and permeated with prices. Economics is primarily interested, from the point of view of social efficiency, in production, exchange, distribution,<sup>2</sup> the structure of business relationships, and social control. Management and accounting closely parallel these interests, from the point of view of enterprise efficiency, with production, buying and selling, expense classification and control, property rights and equities, and the matrix of business law within which the enterprise operates. Their interests are nicely paired, although their differing points of view result in different perspectives: the one regards a whole composed of particulars; the other a particular enmeshed in a whole.

The Parallel between Economics and Managerial Accounting

<i>Economics</i>	<i>Management</i>
Social efficiency	Enterprise efficiency
Production	Production
Exchange	Buying and selling
Distribution <sup>2</sup>	Expense classification
Structure of business	Rights and equities
Social control	Business law

The main line of development of each of the three has to do with entrepreneurs seeking pecuniary profit in an individualistic-competitive business world. The subject contents are similar, although their points of view, perspectives, and objectives differ. Many of the concepts and considerable of the logic of economic theory will prove useful in developing a theory of managerial accounting: especially the contrast between fixed and variable costs and the closely related contrast between long run and short run, the technique of marginal analysis (incremental revenues and costs), and the concept of opportunity costs.

*Method.* Finally, the logic must be reduced to a practical method. Principles guiding collection of data to aid in solving a vast array of intricate managerial problems become complex. Yet a practical method, based on these principles, must be simple enough and automatic enough to be workable with ordinary grades of clerical help.

<sup>2</sup>"Distribution" in economic theory traditionally refers to the distribution of the national income among the agents of production. Thus distribution theory deals with rent, interest, wages, and profits.

Modern mechanical tabulating and calculating equipment will give much needed assistance. More can be accomplished by establishment of rigid routines incorporating skillfully devised division and specialization of clerical labor. These devices and the ingenuity of the system deviser must be stretched to their limits to give the voluminous detail, flexibility, and timeliness necessary to a management operating under present rapidly changing business conditions.

#### LIMITS OF STUDY

A managerial rather than a legal-financial approach to accounting requires redefinition of the scope and limits of the subject. In some respects, managerial accounting includes more than the range covered in traditional treatments; in other respects, less.

##### *Common Limitations*

Managerial accounting shares two important limitations with conventional legal-financial accounting:

1. Both are enterprise-centered. Either may consider a division of government as an enterprise. Neither excludes philanthropic or eleemosynary organizations. Traditional accounting is self-limited to data reporting actual operations of the enterprise; it "keeps its eyes in the boat." Management, and hence managerial accounting, is more catholic, attending to data reporting environment as well as enterprise activity; management attends to waves, winds, and clouds as well as to the condition and progress of the boat. However, it attends to external phenomena only in terms of their implications as to enterprise welfare.

2. Both exclude intangibles. By definition, intangibles are unmeasurable. Since they cannot be reduced to numerical values, they cannot enter the journals, ledgers, or financial statements of traditional legal-financial accounting or the system of standards, records, and reports of managerial accounting.

##### *Legal-financial Accounting*

Traditional legal-financial accounting has become coextensive with the double-entry system. Accounting cost systems are differentiated from statistical cost systems by this criterion.<sup>3</sup> The former ties in with the general ledger through a system of control accounts, whereas

<sup>3</sup> Speethrie, *Industrial Accounting*, Chap. 26, Prentice-Hall, Inc., New York, 1942.

the latter does not. The whole double-entry system is directed at producing the financial statements, virtually to the exclusion of all else. As a result, traditional accounting is limited to pecuniary aspects of status and operations.<sup>4</sup> Accounting procedures may provide for recording, summarizing, and reporting machine or labor hours, pounds of materials or steam, as grudging concessions to the needs of management. But all such data are regarded as secondary, as mere memorandums, not important enough to require internal check or independent audit.

Traditionally, the double-entry system has been limited to historical data and to a single set of values.<sup>5</sup> Arguments may arise as to whether *the truth* is revealed by first-in, first-out or by last-in, first-out computations. One accountant<sup>6</sup> contends that either of these methods is accurate while the moving average (which must always lie between) is inexact and contains a small margin of error. Nowhere in traditional legal-financial accounting does one find explicit insistence on the dependence of values on purposes and situations except in such gross instances as the preparation of a statement of liquidation or the sale of an owner's equity.

### *Managerial Accounting*

Enterprises are directed and operated by management through a system of orders, records, and reports. Managerial accounting is conceived as coextensive with this system. This sharply limits the scope of the study. Intangible factors are immensely important in most managerial problems but are neglected in this study as being beyond the grasp of the system of orders, records, and reports. Similarly, socioeconomic data are incorporated only in the standards originating outside the field of managerial accounting but brought into the system for comparison with performance data.

Beyond these limitations, the subtitle tells the story: *A Managerial Approach to Industrial Accounting*. *Managerial* is intended to exclude the legal-financial aspects of accounting. *Industrial* removes from consideration banks, governments, wholesalers, retailers, insurance companies, brokerage houses, and public utilities. *Accounting* eliminates engineering.

<sup>4</sup> Rorem, *Accounting Method*, p. 10, University of Chicago Press, Chicago, 1935.

<sup>5</sup> Taylor and Miller, *Intermediate Accounting*, p. 6, McGraw-Hill Book Company, Inc., New York, 1933. For a contrary view see Victor Z. Brink in the *Journal of Accountancy*, pp. 284-292, April, 1940.

<sup>6</sup> C. L. Van Sickle, *Cost Accounting*, p. 37, Harper & Brothers, New York, 1938.



Within these boundaries much remains. A great many orders included in the system of orders, records, and reports take the form of standards or estimates—traditionally excluded from accounting until the rise of budgets and standard cost systems. Records and reports may cover virtually the entire history of an enterprise. The system of orders, records, and reports includes all bargaining transactions to which the enterprise is a party and a host of managerial transactions occurring wholly within the enterprise and solely by authority of the management. Thus, as here conceived, *managerial accounting* includes most of general financial accounting, all of cost accounting, and all of production control.

#### GROWING IMPORTANCE OF MANAGERIAL ACCOUNTING

Managerial problems are becoming more complex and more difficult.<sup>7</sup> As a result, management needs more data, reported more promptly, more sharply oriented with respect to managerial problems and objectives, and more fully valid with respect to the changing environment of the enterprise. Major trends tending to increase management's need for data and for sharper focusing of data on problems are

1. The growing scale and complexity of industry
2. The increasing use and importance of fixed capital
3. The increasing range and tempo of change
4. The increasing social control of business

#### *The Growing Scale and Complexity of Industry*

Growth of population and improvements in transportation and communication have greatly expanded the markets in which an enterprise may sell its product. This and concurrent technical advances have tended toward greatly expanded size of economic units. Inventions in bookkeeping, organization, and other managerial devices have solved some problems of scale only to make possible ever-increasing size, giving rise to harder problems of articulation, coordination, and supervision of the various activities of an enterprise.

Specialization of function has become necessary, extending upward through the organization until management itself is thoroughly divided and specialized. As details have passed progressively beyond the im-

<sup>7</sup> See J. M. Clark, *Economics of Overhead Costs*, University of Chicago Press, Chicago, 1923, Chap. I, on the gradual emergence of overhead costs and problems associated therewith.

mediate supervision of the head of the business, authority has been increasingly delegated to functionally specialized assistant managers. Increasing specialization accompanied by increasing delegation of authority to these specialists has set up powerful centrifugal forces within the enterprise. Department heads tend to set up their own objectives and to pursue these goals with increasing independence. Cross-purposes develop, and departments tend to duplicate or to nullify one another's efforts.

To cite examples, first consider a department store with buyers heading commodity divisions. The head of Ladies-Ready-to-Wear has come up from a successful chain. He knows there are a hundred poor people to every rich one. He tends toward low-priced merchandise and bargain-sale tactics. The head of Chinaware came from an exclusive specialty shop. He believes in the gospel of gross margins. He tends to handle high-priced merchandise and to adopt "sales methods of quiet dignity." The inconsistent result did not appeal to any group of potential customers, and the store was soon closed.

As a second illustration, consider a large steel company operating both roughing and finishing mills, organized as separate subsidiary corporations. Materials are transferred from roughing mills to finishing mills at arbitrary prices set to cover production costs plus a "fair" profit. Both roughing and finishing mills are operating below plant capacity. To recover part of the otherwise idle overhead costs, the roughing mills sell below average cost to independent finishing mills. By so doing, the roughing mills are enabled to run at nearly full capacity. The small loss on business done with independents is more than offset by profits on goods going to the consolidation's finishing mills, resulting in a small bookkeeping profit. But finishing mills of the consolidation meet stiff competition from independent mills, due primarily to lower raw-material cost of the latter. Furthermore, since the roughing mills are making profits while the finishing mills are not, executives of the former receive profit-sharing bonuses and promotions while managers of the latter receive neither. Since roughing mill managers see nothing wrong in the arrangement, their exclusive promotion to top executive positions of the consolidation tends to perpetuate the system.

In each instance, the enterprise had grown beyond the abilities of its managers properly to coordinate its operations. The result was the setting up of departmental objectives independent of those of the company as a whole. With various departments working at cross-purposes, profits fell and the welfare of the enterprise suffered. In each

instance, the system of accumulating and reporting data was inadequate to the needs of management.

### *The Increasing Use and Importance of Fixed Capital*

Mechanical evolution has gradually substituted machine methods for hand methods. Machines tend to be more specialized—less versatile—than labor. Moreover, machines are generally purchased and owned, not merely hired as is labor.<sup>8</sup> When plans are changed, labor costs can be reduced by discharging workmen, but machine costs are not so easily curtailed. Displacement of workmen by machines has tended to make enterprises less flexible, less able to make adjustments to meet changing conditions.

Growth in size of enterprises has made possible profitable utilization of ever larger and more specialized machines. Indeed, this has been one of the major objectives in increasing the scale of production. Increasing size of machines has tended to make costs associated with machines more important relative to labor costs, to make machine costs a larger proportion of total costs of an enterprise.

Large volume and standardization make possible continuous-process industry—the American ideal because of its efficiency and extremely low cost per unit of product. However, this mass production is the most specialized and least flexible form of production technique known. With this development, not only has change become more difficult, but experimentation has become increasingly tedious and expensive. The need for managerial foresight has rapidly increased, problems have become more difficult, and mistakes more costly.

Cement making has long been a continuous-process industry. Even in the days of the vertical kiln, each batch of materials passed through a nonvarying sequence of operations involving large amounts of specialized fixed capital. No variation was desirable, and plants were built to permit none. Introduction of the horizontal kiln rendered the vertical obsolete. Material ceased to move in batches and began to flow in a continuous stream. The new method was far more efficient and economical than the old. Investments in vertical kilns were lost. Horizontal kilns required more than five times as much ground area. Entire plants had to be replaced or entirely reconstructed, since the new kiln would not fit building layouts associated with the old. The huge investment and extreme inflexibility rendered the management problem of transition almost impossible of solution.

<sup>8</sup> See *ibid.*, Chap. 2.

Ford introduced mass-production, continuous-process methods in the automobile industry. Highly specialized, efficient, and inflexible machinery was installed to bring the unit cost of the Model T to the lowest possible level. The plant was one of the marvels of the world, but it was thoroughly inflexible. The spectacular shift from Model T to Model A made industrial history. The entire plant was shut down for months for rebuilding and retooling. Millions of dollars' worth of equipment was junked and replaced by new. Ford production was nil during the transition; and ever since, Ford has shared the low-price market with Plymouth and Chevrolet. This experience taught the industrial world the value of relatively flexible equipment. Probably the goal of reduced unit costs will never again lead industry into such large and inflexible production units as the plant that made the Model T.

### *The Increasing Range and Tempo of Change*

Technological changes in methods and equipment have come with increasing frequency. The transition from cast iron and carbon steels to alloy steels is still progressing at an accelerating rate. The plastics and lighter metals are still in the very beginnings of their applications. Flame cutting and welding are still replacing older methods of cutting, forming, and joining structural members. Machine tools grow more rugged, more accurate, faster, and more versatile. Powder metallurgy and electronics are still in their infancy. Packaging has passed through a whole succession of revolutions.

Style has invaded industry after industry and with development of good roads, automobiles, motion pictures, and radios has become increasingly cataclysmic in its incidence. It has invaded kitchen, bathroom, and basement. Stoves, refrigerators, sinks; wash basins, toilets, bathtubs; furnaces, washing machines, radiators, all have become style-conscious. Imagination and motion study are revolutionizing design of both producers' and consumers' durable goods. Much of this change is functional and foreseeable; some appears entirely capricious. Streamlining of automobiles and trains is functional, but streamlining of bathtubs, toasters, and toilets does not seem to be!

Most spectacular of all is social change. One large company attempts to forecast its market 40 years in advance. Customary accounting practice calls for writing off reinforced concrete factory buildings over a period of 40 to 50 years. At the rates of social change to which we are becoming accustomed, such periods are fantastically unreal. Starting in 1910, such a period would include the turmoil of the

First World War, the "biggest boom" of the 1920's, the "biggest depression" of the 1930's, the reform period of the New Deal, the almost complete conversion of industry to war production in the Second World War, and an equally strenuous reconversion to production for a post-war market. Many sound old companies were forced to close suddenly, while giant new plants were built miles from any city. Shortages of equipment, then of materials, and finally of labor placed the highest premiums on ingenuity, flexibility, and persistence. Yet managerial planning and direction somehow must meet such turbulently changing conditions.

### *The Increasing Social Control of Business*

To many it seems as if private business is now on trial for its very life. Governments have gone into one industry after another, wholly supplanting private enterprise in some fields and directly competing with it in others. Representative instances are highways, mails, schools, water supply, and publicly owned power projects. Government has increasingly regulated the field remaining to private enterprise. A long list of depression-born agencies include the short-lived National Recovery Administration and the Agricultural Adjustment Administration and the more permanent Reconstruction Finance Corporation, Securities Exchange Commission, National Labor Relations Board, and Rural Electrification Administration. Older agencies include the Interstate Commerce Commission and the Federal Trade Commission. Many of these continue to extend the range of their jurisdictions and detail of their regulations until enterprise ceases to be either private or individual. Government increasingly uses the tax power to harness and modify the system of private enterprise. Examples are tariffs, excise taxes, and most fundamentally the progressive income and inheritance taxes. Finally, regulations and mandatory records and reports have expanded and complicated accounting and production control records and procedures almost beyond endurance.

Labor refuses to accept the status of a commodity to be bargained for by buyers and sellers in freely competitive markets. Collective bargaining in many industries fixes hours, wages, and working conditions. Unions insist on seniority rights preventing management's selective firing of employees and sometimes verging on becoming rights to promotion. Labor receives equal representation on arbitration boards and shop committees having power to hear grievances and make awards, to set up and enforce regulations governing working conditions,

to determine hours, and otherwise to supply checks on the power of management.

Consumers, too, are organizing. Consumer cooperatives are attempting to organize business ventures along democratic lines. Non-profit consumer advisory organizations have acquired large memberships and have gone from advising members as to qualities and prices of commodities to organizing pressure for reform through legislation and mass boycotts. They urge free publication of Bureau of Standards findings of comparative merits of competing brands, radically stronger food and drugs legislation, and compulsory grade labeling.

*Conclusion: Management's Need for Data*

All this has spelled new and difficult problems for management to meet. Concurrently the latitude within which management may contrive solutions to old or new problems has been restricted. The tendencies outlined above have made necessary a reliance upon "preventive" management in place of the older "remedial" management. Prevention has become far cheaper than waiting for difficulties to become apparent before working out solutions. The scale and inflexibility of modern enterprise make experimentation difficult and expensive. The consequences of error are prodigiously magnified. Prevention must replace remedy. It remains, however, much more difficult, requiring managerial foresight, logical analysis, and sound judgment far beyond the requirements of simpler times.

Management must know more facts and know these facts more precisely, not in qualitative terms alone but quantitatively. Tools of managerial analysis have been developed, recently with great rapidity. Typical of these recently developed analytical tools of management are statistical analysis, cost accounting, and budgeting. Management may not itself be proficient in the techniques of these tools, but it must understand the concepts involved and be able to apply the results obtained by specialist assistants using these techniques. Management must learn to think in terms of samples, averages, deviations, skewness, bias, kurtosis, time series, correlations, and indexes. It must understand and use the concepts of opportunity costs and incremental costs and revenues. It must learn to demand, appraise, and use standards and estimates. It must give up absolutes for relatives and static concepts for dynamic.

Managerial accounting seeks to provide much of the precise, pertinent data needed by management. This study investigates the purposes, premises, logic, and method of such an accounting. Managerial

problems are classified and analyzed to determine the variety and character of data needed. The environment in which problems occur is investigated in order to determine the important factors in each problem situation and how these factors behave along every relevant dimension of variation. Methods are devised for relating the behavior of factors to the problems to be solved—always oriented toward the welfare of the enterprise.

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## CHAPTER 2

### OBJECTIVES OF MANAGERIAL ACCOUNTING

Purposes of the chapter: to give direction to subsequent analysis, to economize by excluding the functionless, to give a strong pragmatic and operational bias to the approach, and to ascertain the requirements imposed upon the accounting system by its objectives.

The system of orders, records, and reports serves three major groups of purposes:

1. It provides for the routine coordination of daily activities.
2. It provides data for legal-financial requirements.
3. It provides information to be used by management as a basis for planning and controlling enterprise operations.

#### ROUTINE COORDINATION OF ACTIVITIES

##### *Objectives*

An enterprise is a collection of persons trying to work together. Coordinating devices are necessary to channelize this activity toward a common goal—the welfare of the enterprise. One such device is the formal organization of the enterprise. An example is the coordination of the activities of a wrecking crew clearing a railroad right of way after an accident. Another example is the coordination of activities of various departments through meetings of the executive committee. The essence of this method consists in a manager observing the progress of work and giving commands that coordinate the activities of his subordinates.

Another device is the system of orders, records, and reports, which provides for transmission of information among departments and for automatic coordination of daily routine activities. Thus the sales department secures an order from a customer. A copy of the order is transmitted to the engineering department, where it initiates and guides engineering activities. These activities result in production of bills of materials, drawings, and processing instructions, which are transmitted to production and purchasing departments. The purchas-



ing department automatically buys necessary materials, and the planning division issues operation orders to the shop. Manufacturing operations result. The product is finished, shipped, and billed in accordance with inexorable routines. Similar routines in the customer's establishment result in his payment of the bill rendered. All this occurs without any overt managerial act!

The same system provides for expeditious and accurate handling of routine financial relationships with other enterprises: for receipt of sales orders, recording and collecting of receivables, systematic handling of purchases, and control of payment of resulting liabilities. On these procedures depend proper servicing of customers, collection and disbursement of cash, taking of discounts and maintenance of credit standing, and prevention of errors and fraud. The clerical work involved is divided and specialized to provide internal checks and to enable necessary records to be kept by low-priced clerical labor. A good system makes errors self-revealing and automatically located. This is the task for which double-entry bookkeeping was developed. Such refinements as specialized journals, subsidiary ledgers, and control accounts carry specialization of clerical labor and automatic location of fraud and error much further. Modern mechanical aids increase the speed and accuracy of the system while further reducing clerical skills required.

### *Importance*

In terms of hours of labor, of cubic feet of files, of square feet of floor space, or of tons of paper, these routines comprise the vast bulk of accounting activities. They constitute a large part of the office work performed by the enterprise. Finally, they bulk large in the economy of the public accountant and therefore in accounting literature and instruction. Here is the stuff to audit. These are the procedures to design for economy, speed, and accuracy and to safeguard from error and fraud by provision of suitable internal checks.

These procedures deserve the attention they receive. They are an essential part of the daily operations of a business. If they break down, hopeless confusion results. Moreover, they supply basic data upon which further accounting analysis and interpretation depend. With little further manipulation, they provide information relevant to maintenance of short-run financial solvency. They provide a quantitative, historical record useful to management as a general aperceptive background. They do not provide data in suitable form for managerial use in planning and controlling enterprise activity.

*Requirements Imposed*

This group of objectives imposes certain requirements on the accounting system:

1. The system must work rapidly and promptly. Slowness may result in poor service to customers, failure to collect accounts, idle time due to lack of materials, or impairment of credit standing.

2. The system must be accurate. Assets tend to escape, and liabilities to adhere.<sup>1</sup> Accurate records with adequate internal check will prevent theft or loss of assets or overpayment of debts.

3. The system must be objective to enable outside audit. Outside audit will supplement the system of internal check in preventing errors and fraud and will give greater weight to reports submitted to other economic, political, or social units.

4. The system must economize clerical time. Motions are minimized to provide the promptness needed and to reduce the clerical cost of operating the system.

5. The system must economize clerical skill. By specialization of duties and imposition of rigid routines, the cost per hour of clerical time is kept down. Otherwise, the volume of clerical work involved could make the system prohibitively expensive.

## LEGAL-FINANCIAL REQUIREMENTS

*Objectives*

Equally imperative are the legal-financial objectives of accounting. Among these objectives are

1. The apportionment of equities
2. Tax administration
3. Social regulation
4. Court action
5. Sale of equities
6. Credit granting
7. Labor and public relations

*Apportionment of equities.* Accounting maintains a record of equities to help in the lawful apportionment of rights in property. A trust may give income to one beneficiary and principal to another. Should the property increase in value, the accountant determines how much of the increase is legally income and how much is increase in value of principal. Payment of dividends to stockholders reduces the security of creditors. The accountant determines the size

<sup>1</sup> E. B. Wilcox and R. H. Hassler, "Foundation for Accounting Principles," *Journal of Accountancy*, October, 1941.

of dividend legally permissible. Dissolution or financial reorganization of a corporation raises many nice accounting problems as to equities properly assignable to short-term creditors, bondholders, preferred stockholders, and common stockholders. All of partnership accounting pertains to proper apportionment of partnership capital and income among the partners. In each instance, the accountant's task is to ascertain the law governing the situation and give effect to it in the accounting records.

*Tax administration.* The extent to which tax laws influence present accounting practice is astonishing. Academicians may debate theoretical advantages of annuity, straight-line, and service life methods of calculating depreciation, but practical accountants investigate effects of depreciation charges on the income tax. The controversy between advocates of original and replacement costs may fill the journals, but practical accountants keep an eye on regulations of taxing units of Federal, state, and local governments. Pay-roll routines, even personnel policies, have been revised in the light of social security taxes. Sales statistics are gathered to comply with state sales taxes if not as a basis for formulation of sales policy. Capital stock taxes and taxes on foreign corporations profoundly affect corporate structures and thereby influence branch house or subsidiary accounting practices. Accountants refer to tax statutes and rulings of tax administrative bodies as a guide, design systems of accounting records that will yield the requisite information, suggest changes in corporate policy and organization, and fill in tax reports as required by law.

*Social regulation.* Governments may seek not only to tax business enterprises but also to control them. Government regulation of enterprises usually exerts a profound influence over their accounting methods. The Interstate Commerce Commission prescribes the account classification and rules of valuation employed by railroads. Public utility commissions exert similar control over accounts of electric power, telephone, gas, water supply, and local transportation utilities. Accounting records of banks and insurance companies are periodically inspected by government officials and are subject to numerous governmental regulations, *e.g.*, concerning valuation of assets to determine solvency. Minimum wage, maximum hour, social security, and withholding tax laws require all enterprises to maintain certain pay-roll records. Without such mandatory records, policing would be entirely impossible.

If a business wishes to float a security issue, it must conform to requirements of the Securities Exchange Commission. These require-

ments primarily concern accounting data to be made accessible to prospective purchasers of securities. If the enterprise wishes to charge different customers different prices, it may feel constrained to keep distribution cost records, which would justify such discrimination under the Robinson-Patman Act. As with keeping account of equities and preparing tax returns, here, too, the accountant's task is to ascertain the requirements of law and to conform as economically as possible.

*Court action.* Accounting records are increasingly being introduced as evidence before judge, jury, master, and commission. Many of the situations mentioned in preceding paragraphs require occasional judicial or quasi-judicial action. Disputes as to ownership of capital or income bring rival claimants to court, each producing accounting data in support of his claim. Tax litigation almost necessarily involves accounting data or accounting method. Rate cases before commissions or on appeal to courts require accounting data to establish fair capital values and to determine the income realized by railroad or utility. Accounting records also appear in evidence in actions brought for breach of contract, both to prove the contract and to establish extent of damages. Similarly, tort actions demand proof of damages, often requiring presentation of accounting evidences. Finally, with increasing scale and complexity of enterprise, separation of promotion, management and ownership functions, and growth of social control of business, accounting evidence plays a progressively larger role in criminal prosecutions.<sup>2</sup>

*Sale of equities.* Aside from strictly legal relationships, there are many bargaining and persuading relationships that require a background of accounting data. Voluntary change in relationships among equity holders is a bargaining process rather than a legal one. Legal positions of various classes of equity holders become merely one element in a complex situation. Economic prospects and market values are often much more important than legal rights. There are too many situations in which the nuisance value of a legal right is worth more in a bargain than the right itself in a court. When market considerations dominate, the accountant indulges in a wholesale scrapping of the conventions ("principles") by which he lives. In the voluntary sale, reorganization, or merger of a corporation or the entrance or withdrawal of a partner, appraisals and revaluations become the order of the day. Accounting principles, such as the lower of cost or

<sup>2</sup> The Insull trial was a notable example. Also note the F.B.I. rule that its investigators must be either lawyers or accountants.

market and cost minus depreciation, are jettisoned. The accountant seeks to determine and report current values: inventories are valued at current market and fixed assets at replacement cost minus an appropriate depreciation allowance, while good will is based solely on earning power.

*Credit granting.* Banks and trade creditors demand accounting information before extending credit, in some cases dictating the content and form of reports. In these instances, the task of the accountant resembles his task when a legal objective is sought: he determines requirements and conforms. With most trade creditors and frequently with banks, the company is in a stronger position and can decide for itself how much data it will supply. In too many such situations, the accountant deviates from recognized accounting practice: reports are "window dressed" to obtain more liberal credit terms.

Occasionally customers want accounting data akin to that required by creditors. Where highly specialized servicing or easy access to replacement parts is important, customers do not wish to acquire products that may soon be orphaned. Buyers of long-term construction jobs often require assurance that bidders and contractors have the financial stability to complete the project. This assurance may take the form of a performance bond, or buyers may merely require submission of accounting data proving a strong financial condition.

*Labor and public relations.* Labor relations increasingly requires a background of accounting data. Profit-sharing plans obviously necessitate a rather complete revelation of profit and loss data. Bonus plans, old-age pensions, guaranteed annual wages, and various insurance plans require maintenance of complete pay-roll data accessible to representatives of employees of the enterprise. Management is increasingly finding that accounting data concerning costs and profits are helpful in conducting collective bargaining negotiations with unionized labor or before arbitration boards.

Public relations is progressively assuming greater importance. The extent of the market in which corporate stocks and bonds are sold and resold, the diversity and number of customers of a single enterprise, and the size of the work force and the labor market from which it is drawn make the external contacts of an enterprise almost as broad as society itself. Largely for this reason, social control has become more detailed and well-nigh omnipresent. Thus public opinion has become much more important to management than it formerly was. Cultivation of a favorable public opinion has required making public increasing data concerning enterprise operations. Recently account-

ants and public relations men have been giving much attention to published annual reports. These are becoming really informative rather than purely a legal formality.<sup>3</sup>

### *Importance*

The legal objectives of accounting are absolutely imperative. An enterprise must submit information required by tax laws and by social regulation, or the police power of the state will put it out of operation. Each additional field of regulation entered by government has given a vast impetus to accounting. Particularly noteworthy have been the income tax, the Securities Exchange Act, various wage and hour laws, social security laws, and anti-price-discrimination acts. Reluctant businessmen do not have to be persuaded of the desirability of spending money to get data required by these laws. Consequently, tax work has vied with auditing as the primary field of activity for public accountants and has received much attention in accounting curriculums and literature.

Aside from requirements imposed by the state, the audience is growing in size and power and becoming more interested in accounting data. Publicized accounting data that do not make adjustments for changes in price levels may tend to amplify swings of the business cycle and to modify profoundly the structure of society. As price levels decline, money profits fall much more than real profits. With rising prices, bookkeeping profits become much higher than real profits. Thus accounting tends to report higher peaks and lower troughs than actually occur. The reaction of public opinion to such perverted information is extremely unhealthy. The public's operations in speculative markets, misled by published accounting statements, tend to aggravate the situation further. All this produces a political reaction making for alternating regimes devoted to curbing and to promoting private enterprise. Compare the prestige of the businessman and the attitude of the Federal government during the boom of the 1920's with those of the depression period of the 1930's.

### *Imposed Requirements*

The legal-financial objectives of accounting impose requirements backed by legal sanctions and by the power of creditors. Among these requirements are the following:

<sup>3</sup> A long list of companies could be cited: United States Steel, Marshall Field, General Motors, and others. Many are using their annual reports to convince the public of a need for lower taxes on corporate enterprise.

1. The accounting system must comply with legal requirements governing classifications and evaluations and sometimes must comply with similar rules imposed by creditors.

2. The system must seek comparability among time periods and among enterprises. Tax laws and price regulations seek comparability among enterprises as a matter of equity and comparability among periods as a matter of administrative necessity. Creditors seek comparability to enable them to interpret and analyze the accounting data they receive.

3. The system must be objective, even to the point of sacrificing pertinence and validity. Objectivity facilitates independent verification by disinterested third parties and tends to minimize bias and fraud. Rules and conventions are followed that enable tax gatherer and resident accountant to agree on profits and resulting tax liabilities. For legal-financial purposes, balance sheet classification tends to run in terms of objects: cash, accounts receivable, inventories, land, buildings, and machinery. Auditors can see these objects and trace their histories. Profit and loss itemization tends to be in terms of objects of expenditure: raw materials, factory supplies, direct labor, rent, radio advertising, etc. These are closely related to objects and have easily investigated histories. For legal-financial purposes, evaluation is a matter of history, not one of current fact. History can be objectively verified by appeal to an adequately documented record: ledgers, journals, and original evidences of business transactions. Current values are likely to be matters of opinion with wide disagreement among "experts."

4. The importance of the problem of solvency, both in law and in credit granting, has resulted in virtually universal grouping of balance sheet items in order of their "currentness," *i.e.*, of their probable conversion into cash receipts or disbursements.

The result has been an accounting system characterized by the conventionality of its methods and its end products—the balance sheet and the statement of profit and loss.<sup>4</sup>

### MANAGERIAL OBJECTIVES

#### *Group Pressures*

Management is the focus of powerful group pressures. Sometimes pressures of all groups can be reconciled and all accommodated. Usually, greater satisfaction for one group involves lesser satisfaction

<sup>4</sup> George Oliver May, *Twenty-five Years of Accounting Responsibility*, Vol. 2, pp. 400-401, American Institute, New York, 1936.

for others. Each group has a minimum level of satisfaction that must be attained, or the group refuses to cooperate and the enterprise ceases to function. The most significant groups exerting pressures on management are

*Owners.* Owners seek larger returns coupled with security of capital. In this corporate-dominated pecuniary age, stockholders desire the largest possible cash return: as much cash as possible, as soon, as regular, and as long continued as possible. However, this cash test should be adjusted for changing price levels.<sup>5</sup> Managers and owners should plan and judge operations in terms of real, not merely nominal, values. This may involve fairly complete adjustment of pecuniary estimates and data for anticipated or experienced changes in the purchasing power of money.

*Employees.* One of the most conspicuous of pressure groups is the employee group. They have long sought higher wages, shorter hours, and better working conditions. The great depression focused attention on various aspects of security. Both Federal and state governments have become more responsive to demands of the labor group. Some of the results have been the wage and hour law, the labor relations act, and social security legislation. These have profoundly affected personnel problems of management. In addition, many managements have gone beyond legally established minimums. Group insurance, sickness and accident benefit plans, guaranteed yearly wages, spread-the-work schemes, and other employee helps have been instituted without compulsion of law. They all give rise to managerial problems of planning and control, and each tends strongly to complicate the accounting records kept by the enterprise.

*Customers.* Customers seek better quality, lower prices, and improved services. Producer customers have long employed purchasing specialists and inspectors to protect their interests. Consumer customers have become increasingly articulate. As a result, laws have been enacted governing grading, labeling, and advertising. Government-published bulletins, "buymanship" courses in schools, and consumer organizations supplement formal legal requirements. Many customers seek special privileges: preferred deliveries, extra discounts, advertising allowances, free deals, and special designs.

<sup>5</sup> See Sweeney, *Stabilized Accounting*, Harper & Brothers, New York, 1936; also numerous articles by the same author in the *Journal of Accountancy* and in the *Accounting Review*; also, more popular, more virulent, and marred by error, MacNeal, *Truth in Accounting*, University of Pennsylvania Press, Philadelphia, 1939. Really better than his book are articles by MacNeal in *The Nation*.



*Competitors.* Competitors bring pressure through markets, trade associations, and governments. Management must meet prices, quality, and services offered by competitors in order to make sales and stay in business. It must offer wages, rents, and interest sufficient to obtain an adequate supply of productive agents in competition with other enterprises. Competitors bring direct pressure to standardize trade practices, to maintain prices, and to restrict outputs. Trade associations are organized for these purposes and to exchange information, advertise the industry, and influence legislatures. Governments have been persuaded to coerce competitors. The high point of pressure by competitors through governments was reached under the National Recovery Act. The Miller-Tydings Act for resale price maintenance, the Patman-Robinson Act prohibiting price discrimination, the Interstate Commerce Commission's regulation of interstate trucking, and a multitude of discriminatory local laws and practices remain monuments of pressures by competitors.

*Governments and Public.* Governments seek tax revenues, maintenance of the peace, and the public welfare. In addition, managements are subjected to intense pressures for maintenance of charitable, religious, and political institutions. Public opinion (and fear of new laws) is a factor in all the relations outlined above. Public interests are also protected by zoning laws, pollution prohibition, conservation measures, monetary controls, and many other governmental interferences with individual gain seeking. Widespread public feeling condemns combinations into huge trusts, domination by financiers and bankers, and other predatory practices.

*Management.* In addition to these pressures, managers have interests of their own. As the scale of industry has increased and the corporate form become dominant, ownership has been divorced from management. While enterprises supposedly compete for profits, their managers engage in a private competition of their own, seeking promotion, prestige, power, and higher salaries.<sup>6</sup> As stockholdings become very widespread, management has tended to replace ownership as the power behind the corporation.<sup>7</sup> This has sometimes led to nepotism,

<sup>6</sup> Clark, *Social Control of Business*, p. 161, University of Chicago Press, Chicago, 1926.

<sup>7</sup> Berle and Means, *The Modern Corporation and Private Property*, The Macmillan Company, New York, 1933. Other influences have tended in the same direction, e.g., expanding portfolios of banks and insurance companies; see Tippetts and Livermore, *Business Organization and Control*, D. Van Nostrand Company, Inc., New York, 1932.

to rigged markets, to false reporting, and to managerial speculation in the shares of their companies.<sup>8</sup> However, there are factors tending to harmonize the interests of management and owners; managerial salaries tend to rise with increasing profits and often include profit-sharing arrangements.

*Conclusion: economic efficiency.* Managers must strive to keep each pressure group sufficiently satisfied to assure continued cooperation. Beyond the necessary minimum satisfaction of owners, employees, customers, and public, management may attempt further satisfaction of one or more groups. The extent to which this is possible depends upon the economic efficiency of the enterprise, upon the ratio of income to outlay.<sup>9</sup> Thus the fundamental goal of management is maximizing income relative to outlay in order to maximize the pool to be divided among the pressure groups.

After the pool has been maximized, it must be divided. Management should know how changes in satisfaction accorded one group will affect the ability to satisfy others; *e.g.*, how will a wage increase affect the power of the enterprise to improve quality or to pay an extra dividend? Management must know costs and profit margins to react intelligently to the maelstrom of pressures of which it is the center. This study is limited to an analysis of accounting as a tool of management in management's quest for economic efficiency. It does not deal with the problem of division among the pressure groups after economic efficiency has maximized the aggregate wealth to be divided.

### *Managerial Planning*

All managers first plan and then execute: both in a social environment that exerts certain controls and that management attempts to influence. Taylor's division of management into planning and performance remains fundamentally significant.<sup>10</sup> To it must be added the task of representing the enterprise in its contacts with employees, customers, sources of supply, governments, and public. Accounting has a major role to play in each of these three major tasks of management. In turn, these three functions of management should

<sup>8</sup> See Hamilton, *Current Economic Problems*, p. 206, University of Chicago Press, Chicago, 1925.

<sup>9</sup> This parallels the physical concept of efficiency: useful work accomplished divided by energy expended.

<sup>10</sup> F. W. Taylor, *Scientific Management*, Harper & Brothers, New York, 1911; also Taylor, "A Piece Rate System," *Transactions of the American Society of Mechanical Engineers*, Vol. 16, 1895. Probably Taylor made the first clear division of management into planning and execution.

provide the orientation for managerial accounting. The conduct of relations with other social groups has been adequately covered for the present under Legal-financial Objectives above. Managerial planning and control of operations will be discussed below.

Planning may be further analyzed into (1) formulation of policy; (2) development of organization pattern; (3) selection of product design, productive techniques, and resources; and (4) pricing. The tangible detailed aspects of each of these types of planning fit into the patterns of engineering economy studies.<sup>11</sup> Many data for such studies come from accounting records, and these records should be designed and kept with this in mind. Budgets are another device used by management in choosing among rival plans.<sup>12</sup> Accounting records and reports provide both data and pattern for budgets. Even where both comparative cost studies and budgets are inapplicable, the judgment needed to resolve the most intangible problems should be nourished by a background of information, largely supplied from accounting records.

*Policies.* One of the objectives of managerial accounting is to aid management in its formulation of policies. Policies are relatively permanent, general plans of action laid down by management to guide enterprise activities. A degree of permanence makes for consistency in relationships and avoids the costs of repeated investigations to solve series of similar problems. A general plan goes far toward coordinating activities contemplated by the plan. A few such plans can be worked into a coordinated system more effectively than can the myriad of detailed activities governed by such a system. Policies enable management to delegate authority to subordinates without losing unity of command. Thus policies produce consistency, economy, and coordination.

Policies may be arranged in a hierarchy paralleling the organization pattern. The most general of policies are formulated by stockholders

<sup>11</sup> See Grant, *Principles of Engineering Economy*, The Ronald Press Company, New York, 1938. Grant's book analyzes the selection of designs, techniques, and resources but does little or nothing with policies, organization, or pricing. Also see "The Relationship of Cost Accounting and Engineering Economy," *Journal of Engineering Education*, April, 1941.

<sup>12</sup> McKinsey's *Budgetary Control*, The Ronald Press Company, New York, 1923, does not develop the use of budgets for selecting the most desirable among several rival plans of action, although McKinsey in his practice used them for this purpose in many if not most of his studies. The book is concerned mostly with the mechanics of budgetmaking and the use of budgets in obtaining conformance with the policies adopted.

and board of directors. Each lower rank of executives formulates successively more detailed plans within an ever-narrowing frame of policies imposed from above. Examples of broad policies decided by stockholders or board of directors are choice of industry, of competitive level, and of degree of aggressiveness. Examples of policies formulated at departmental levels are decisions with respect to completeness of line, channels of distribution, sales appeal, speculative purchasing, training and compensation of personnel, and sources and protection of capital. Narrower and more detailed are the procedures governing, for example, the routes of materials through the factory or of forms through the office.

*Organization.* Most enterprises are large enough to require a group of men working together to achieve the goals set forth in the policies formulated. If such a group is to direct its activities toward a common goal with maximum effectiveness, there must be leadership and authority. If the group is large, the leader must select assistants to help him direct activities of the group. Such a leader and his assistants constitute the management of the enterprise. For greatest managerial efficiency, a planned division of labor among managers is required. Each must be assigned definite and related activities to supervise. To each must be delegated the necessary authority to carry out activities assigned to him. Each should be held responsible for performance of activities over which he has authority. It is this plan of division of labor among managers which is meant by the term *organization pattern*.

The organization pattern and managerial accounting interweave and interact. The organization pattern imposes one of the basic classifications of accounting data—classification according to administrative responsibility. The possibility of measuring performance and thus fixing responsibility is one factor to be considered in establishing the organizational pattern. Other factors are the general policies established, the available personnel, and the relative costs of different possible organization patterns.<sup>13</sup> Departments and jobs are specialized in order to employ less versatile and consequently less costly personnel and to make fullest use of talents hired. These specialized activities must be coordinated. When specialization is greater, coordination becomes more necessary, more difficult, and more expensive. Greater specialization reduces one set of costs while increasing another. The

<sup>13</sup> Cost was an important factor in the reorganization of field supervision of a grocery chain.

proper balance is achieved when total cost is minimized. Some useful cost data can be obtained from accounting records of the enterprise, and some may come indirectly from accounting records of other enterprises. Beyond this, the problem is intangible and rests with the judgment of management.

*Selection of designs, techniques, and resources.* Policies govern product design in a general way. An enterprise may elect to enter the quality or the price market. Typically this is a decision for the board of directors: full of imponderables, requiring a high order of judgment, of great importance, affecting all departments, and seldom reducible to a simple problem in cost comparison. The policy adopted will set limits to design as to tolerances, finishes, and grades of materials. Yet these policies may be abandoned or altered, and there are gradations within the limits set by policy. Thus it becomes important to know cost differences associated with any contemplated change in design. Often many designs will acceptably meet the requirements of market and policy. Then cost considerations govern, and accounting data become of first importance.

Closely related to product design is selection of processes, productive resources, and techniques. A choice between plating and enameling runs into product design, but a choice between hot and cold methods of degreasing preliminary to enameling does not. Almost always choice of process involves also design of product or choice of productive resources, often both. Perhaps an exception is design of office and accounting procedures. These may result in identical reports and may use the same paper and office equipment, even though the procedures are rather different. A nearly pure illustration of selection of productive resource is choice of plant location. Much the same product can be turned out with the same processes in Minneapolis or Chicago; in city, suburb, or country. Selection of designs, techniques, and resources is most exactly approached by comparative cost studies.

*Establishing prices.* Establishing prices is another important planning problem of management. Usually the problem is one of selling more units at lower prices or fewer at higher. Accounting data may be embodied in budgets to show how great an increase in unit volume will be needed to compensate for any given decrease in price. Such a study may anticipate an expansion of plant capacity, seek a solution to the problem of partial utilization of existing capacity, or be concerned with filling in slack periods, diurnal, cultural, seasonal, or cyclical.

Management also meets problems of price discrimination. Sometimes customers are charged different prices because costs of serving them differ. Thus, cash customers may be charged less than those who buy on account; delivery service may carry an extra charge; utilities may impose a minimum charge for standing by ready to serve; electric utilities and motion-picture theaters may encourage off-peak business by lowering prices in such periods. Such price discrimination is based upon differences in costs of serving various classes of customers. Evidently, accounting data should disclose such cost differences.

In other circumstances, customers are charged different prices because of difference in ability or willingness to pay. The commodity classification of railroads is more in consonance with ability to pay than with any cost differences. Publishers introduce a new novel at substantially higher prices than those eventually charged. Much contract work is let at prices determined by intensity of competition, ability to divide the market so that cut prices to one customer need not be reflected throughout the market, and specific cost conditions in the producing plant.<sup>14</sup>

Finally, management must make the sum of all prices collected equal or exceed the aggregate cost of the enterprise. In doing this, management finds some help in a cost accounting procedure that accumulates costs by products or jobs, arbitrarily allocating general costs among cost units involved. This gives management a par for each sale, a par that must be reached or exceeded as a matter of averages.

### *Managerial Control of Performance*

After policies have been formulated, an organization effected, and designs, techniques, and resources selected, management must operate the enterprise. This involves successive processes of motivation, inspection, and correction. Detailed orders are given, which will continuously work out policies adopted. Such orders originate at various points in the organization and flow down through successive levels of authority to men finally charged with performance of detailed activities. Reports flow back up through the organization to indicate discharge of responsibility and degree of success achieved. Such reports are necessary to laying further plans, revising policies, and issuing further orders to continue operation of the enterprise.

<sup>14</sup> J. M. Clark's *Economics of Overhead Costs*, University of Chicago Press, Chicago, 1923, contains much material on the relation of differential costs to pricing and price discrimination.

Three phases of operations must be controlled: (1) achievement, (2) expenditure, (3) investment.

*Achievement.* Management establishes standards of achievement and measures achievements of subordinates against these standards. The sales department is expected to procure a predetermined sales volume. The advertising division is expected to develop a certain number of "leads." Factory departments are given production schedules to meet and are governed by quality standards established by engineering and enforced by inspection. The accounting department is expected to produce certain reports on established dates. Every department has its tasks to perform, with standards of quantity and quality to meet.

Many of these standards are merely restatements of managerial plans discussed earlier in this chapter. They originate in the process of managerial selection among rival policies, designs, or resources. Others originate in engineering studies—which may also take the form of comparative cost analyses. A few standards of achievement take the form of aggregates and are incorporated in the system of standards, records, and reports that is managerial accounting. Records of actual performances are accumulated and compared with these standards. Deviations lead to managerial investigation and remedial action. Most standards of achievement are applied item by item, as in testing diameters with a go, no-go gauge. These generally are not incorporated in the system of records and reports, although records of successes and failures are usually accumulated and reported.

*Expenditures.* Achievements are attained through expenditures. Each task assignment is accompanied by an expense limitation. These limitations, or standards of expenditure, enter the system of standards, records, and reports and are there matched against a record of performance. Deviations are an indication of need for managerial investigation and action.

Standards and measures of expenditure may be in physical or in pecuniary terms; frequently, perhaps usually, they are established in both physical and pecuniary terms. Material expenditures may be stated in tons or dollars; labor, in hours or dollars. Many burden items are sometimes put in physical terms, *e.g.*, pounds of coal, kilowatt-hours of electricity. The physical and pecuniary standards of expenditure contrast to the standards of achievement. Sales achievement may be measured in physical or pecuniary terms. All other achievements tend strongly to be measured solely in physical terms.

Standards and measures of expenditure are often stated as relatives: as ratios or percentages of achievements, *e.g.*, hours of janitor labor per hundred square feet of window area cleaned or dollars of cost per ton-mile carried.

*Investment.* Employees are expected to attain standard achievements without exceeding standard expenditures or employing more than standard investments. Managerial control of investment follows the same general pattern as managerial control of achievement and of cost. Standards are set, and performance measured and compared with standard.

Short-run solvency depends largely upon managerial control of investment in current assets: cash, receivables, and inventories. Accounting helps management very much in this respect, providing answers to such questions as the following: What is the enterprise's cash balance? How much money will be collected from accounts receivable in the near future? How is volume of cash sales running? How much money will be needed to meet maturing accounts payable? How much for pay rolls and current operating expenses? Are there long-term obligations maturing, and how much cash will they require? How large is the inventory, and how rapidly is it turning over? Many managements require their accounting departments to prepare daily or weekly reports covering these data. Close watch is kept over cash balances, receipts, and disbursements. A customers' ledger exhibits the balance in each customer's account at all times and gives prompt warning of accounts falling behind scheduled maturity dates. Perpetual inventories show the amount of each item on hand, indicate slow-moving items, and disclose losses and pilfering.

Fixed assets are controlled through plant ledgers, appropriation procedures, and loading records. The plant ledger contains an account for each piece of equipment owned by the enterprise. Each account carries such data as date of acquisition, price, source, description, depreciation rate, repair and maintenance record, and final disposition date and price. The appropriation procedure requires that each project be detailed, with savings and costs estimated. After authorization, a record is maintained and compared with the estimates shown on the request for the appropriation. Loading records show the backlog of work ahead of each piece of equipment, thereby revealing inadequacies and chronically idle items. The record indicates what additional equipment is needed and which items can be liquidated without curtailing operations.



### *Objectives of Cost Accounting*

As a rule, cost accounting data are not required by government<sup>15</sup> or submitted to other outside interests. Thus the purpose of cost accounting is usually confined to supplying data to help management plan and control enterprise activities.

Cost systems generally are constructed to yield one or more of the following:

*Departmental costs.* Departmental costs do not and are not intended to aid in price setting. They may help solve some problems of policy; e.g., shall a company continue operating a plating department, or should the department be closed and work be sent outside for plating? Primarily, however, departmental costs are intended to help establish executive control. For this reason, the chart of accounts should duplicate the organization chart. Moreover, provision should be made for comparing current performance with a standard, either a budget or past performance. In this manner, responsibility can be fixed for substandard performance.

*Product costs.* Product costs are intended as an aid to managerial setting of prices; they set a standard by means of which prices obtained may be judged. Product costs also aid in settling some questions of policy; e.g., should a product be manufactured or purchased? Product costs may also give some feeble assistance in control of operations. By comparing product costs of successive accounting periods, unfavorable trends may be discovered and further investigated to find causes and remedies.

*Process costs.* A process cost system is usually associated with continuous-process manufacturing. In such factories, departments are set up on a product basis and subdepartments on a process basis. Consequently, process costs automatically yield product and departmental costs as well. The greater detail of process costs provides information of greater value to management in approaching problems of planning and controlling performance. Likewise, the cost system involves more clerical work and greater expense of record keeping.

*Job-order costs.* In intermittent-repetitive and in contract production, costs are sometimes kept according to each batch of product, each shop order, or each customer order produced. This method of cost accumulation gives a standard against which prices received can

<sup>15</sup> Public utilities are a large class of exceptions excluded from the present study by its limitation to industrials. War orders, both on a cost plus basis and because of renegotiation clauses, may involve submitting cost data to government. See Treasury Decision 5000 for admissible costs.

be judged. It helps management decide whether to buy or produce piece parts or even specific operations on particular parts. By maintaining a comparative record of costs on successive batches of similar products, unfavorable trends can be isolated for further investigation. The detail makes the job-order system the most expensive of cost procedures.

*Standard costs.* Standards, or norms, are needed in order to evaluate performance data in any type of cost system. Conversely, the standards are corrected and kept on a current basis by comparison with performance data. For appraising the adequacy of prices obtained, normal or standard costs generally prove more satisfactory than so-called "actual" costs. Furthermore, clerical work is greatly reduced when permanent standard costs are used instead of detailed historical costs. The standards can be compared with relatively comprehensive groupings of current data to fix responsibility and establish executive control. Moreover, where significant deviations are found, a more detailed investigation can be made, leading to executive action correcting either the substandard condition or the standard itself.

#### *Imposed Requirements: Multiple Truth*

The ultimate objective of management is economic efficiency. The ultimate test of managerial accounting is the aid it gives management in attaining its goal of economic efficiency. Seeking this goal, management plans the activities of the enterprise, controls its operations, and conducts its social contacts. These activities of management impose certain requirements on managerial accounting as to classification, as to evaluation, and as to method. Data appropriate to one managerial problem are not necessarily appropriate to all. Some problems will require one classification of data; some another. Evaluation of certain items will vary from problem to problem.

*Classification.* Managerial planning requires classification of accounting data according to rival programs of operations. For example, problems of sales policies may require classification of sales and of selling expenses in various ways: by products, by territories, by kinds of customers, or by sizes of orders. On the basis of accounting data classified in these ways, management may decide to drop a product line, extend operations into new territories, cater to some economic classes and not to others, or stop paying commissions on sales orders below some established size.

Fixing responsibility and establishing managerial control of subordinates require classification of expenses according to the pattern of

individuals' authorities. For example, having classified expense items according to the part each plays in alternate plans in order to choose rationally among the plans, they must be reclassified to establish responsibility for success of each phase of the chosen plan.

Conduct of social contacts may require still other classifications, by liquidity, by contracts, or in special ways dictated by governments or creditors.

Managerial accounting must begin with a basic classification that can be grouped and regrouped economically as various needs arise. Two principles are essential to securing such flexibility in classification of data. (1) Transactions should seldom be divided; in the initial record each business act should be recorded whole. (2) Transactions should be merged only when components of the resulting class of data are homogeneous along all dimensions of all managerial problems, be they problems of planning, control, or social contacts.

*Evaluation.* Values have meaning only in terms of problems and situations. The frame of reference must be known before evaluation can have significance. In approaching problems of managerial planning, the factors to be considered should be listed and values assigned that clearly reveal the differences among the plans with which these values are associated. For example, if one plan calls for a larger volume of production than another, the physical outlays associated with each plan should be estimated according to their laws of behavior. These physical outlays should be converted to pecuniary valuations in terms of the behavior imposed by the real economic world. The law of diminishing return will influence physical magnitudes of outlays; quantity discounts and overtime premiums will influence their pecuniary evaluations. In general, neither physical changes nor pecuniary changes will follow a linear rule of direct proportionality.

In approaching problems of managerial control, elements to be controlled should be determined and sorted according to administrative responsibilities. Each should be weighted according to its importance as determined by its effect on the ultimate objective of economic efficiency and according to the abilities of the to-be-controlled subordinates to influence the item. For example, a certain product may be ruined in the process of final assembly by poor soldering or by rough handling. The foreman's efficiency is a composite of his skill in avoiding these two causes of spoiled work. In constructing an index to measure the foreman's efficiency, both factors should be represented with appropriate weighting. In terms of influencing the enterprise's profits, poor soldering may be more important than rough handling:

more units may be spoiled in this manner, salvage costs to repair damage may be higher, material may be spoiled at a later stage of processing after a greater amount of labor and materials has been expended. On the other hand, rough handling may be entirely within the control of the foreman and his subordinates, while poor soldering may be partially due to poor cleaning of materials by a prior processing department, to poor quality solder or flux, or to poor workmanship—only the last of which is subject to control of the foreman.

The conduct of social contacts may impose a historical or a conventional valuation. Unbiased objectivity may be more important than biased relevancy. In determining the amount of dividends that can be declared without creating a directors' liability, assets are valued at historical cost minus depreciation estimated in accordance with certain traditional conventions. Personal property tax laws and administrators require valuations at arbitrary percentages of historical or of present market values. Managers, confronted by the problem of replacement (managerial planning), may treat the same items as sunk costs to be valued at resale price, often merely scrap value. In negotiations preceding a merger of two enterprises, the same items may be valued at reproduction cost minus depreciation proportional to age.

Valuations change with every problem and every situation. Methods of approach to valuations are the same for any one *type* of problem but differ for different types. Valuations for problems of managerial planning are always approached the same way, although different values will be found for different problems. Valuations for problems of managerial control are always approached in a radically different uniform manner. Again, various problems of control will produce different values, although the method of valuing remains the same for all such problems. Valuations for purposes of conducting social contacts vary both as to values found and as to approaches employed.

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## CHAPTER 3

### PREMISES OF MANAGERIAL ACCOUNTING

Purposes of the chapter: to analyze the environment of management, to demonstrate the inadequacy of the traditional premises, and to provide a basis for subsequent analysis.

The preceding chapter outlined the purposes of management and of managerial accounting. The present chapter analyzes the situation in which management and managerial accounting operate. Between them, the two chapters detail the problem (a purpose in a situation) to be investigated. This will complete the orientation and prepare the way for analysis of managerial planning and control.

The situation, or environment, is largely an imposed configuration, subject to managerial manipulation only in relatively minor respects. From a broad social viewpoint, no one management changes the environment very much. Yet these minor changes are the very life of the enterprise. From this environment, management must draw the productive agents necessary to the attainment of managerial objectives. Management must sell its product to its environment to secure the means of purchasing further productive resources and so to maintain the enterprise in continuous operation. The environment prohibits some types of actions, permits others, and facilitates some of those permitted. Thus the environment provides the starting point for managerial action, the premises of managerial thought.

Premises should be reviewed before the theory is developed in order to guard against inconsistency and to indicate the area of applicability of the analysis. They should be derived from observation of the area to which conclusions are to be applied. They should be self-consistent and adequate. A few proper premises will support an abbreviated analysis giving useful but meager conclusions. A few more will greatly extend the theoretical structure and enrich conclusions as to number, range, precision, and applicability. Further gains can be obtained by adding premises derived from observation until limits set by need for simplicity are approached. Evolving techniques and mechanical aids continually shift these limits, allowing progressively closer approximation of premises to observed fact.

As compared with economic theory, the present study covers a narrower field, both in time and in space. Economics studies a society, whereas accounting and management are centered on an enterprise. This leads to differences in objectives, perspectives, and orders of magnitude. Economics is concerned with the social welfare; accounting and management with the welfare of an enterprise. From the economic point of view, society is composed of enterprises interacting in markets. From the accounting and managerial viewpoints, an enterprise functions in a social matrix.

Economics deals with large phenomena in a large way. Its functions are continuous; its variables change by infinitesimals. The enterprise of accounting and of management belongs to the economic microcosmos. Economic infinitesimals become finite, often very large, when viewed from a managerial perspective. Managerial functions are discontinuous; their variables change by discrete quanta determined by the nature of the agents employed. The attitude toward time undergoes a similar metamorphosis in shifting from the economic to the managerial perspective. Laws governing a society should be judged by their long-run consequences. Price theory is chiefly centered on ultimate equilibrium. The enterprise is relatively ephemeral. It must profit in the short run, or it cannot survive to enjoy later benefits.

The society is more inclusive and enduring than the enterprise. Consequently the premises of managerial thought should be less general and be descriptive in greater detail than those of economic theory. Since the area to be fitted is smaller, the fit may be more exact. Accounting has no claim to greater generality and simpler, less accurately fitting premises. It is the tool of management, and its perspective should be that of management. As the analysis proceeds, it will become apparent that the traditional premises of accounting theory have been oversimplified and that as a result much of the potential usefulness of accounting as a tool of management has been unrealized.

As compared with economic theory, the present study emphasizes short-run analysis with its marginal paraphernalia and follows the company approach rather than the industrial or social.<sup>1</sup> As com-

<sup>1</sup> F. H. Knight, *Risk, Uncertainty and Profit*, pp. 76-80, Houghton Mifflin Company, Boston, 1921, contains a list of assumptions of classic price theory.

J. M. Clark, *Preface to Social Economics*, pp. 22-41, Rinehart & Company, Inc., New York, 1936, also contains such a list, somewhat loaded for the purpose of suggesting the equal validity of opposites.

L. C. Marshall, *Readings in Industrial Society*, 1st ed., University of Chicago Press, Chicago, 1918, is largely given to adaptations of varying views on the

pared with traditional accounting, the present study emphasizes the roles played by objectives and situations, particularly with respect to the impact of these factors on cost and income behavior.<sup>2</sup>

## NATURE OF MAN

### *Wants and Diminishing Utility*

Economics is a study of how human beings satisfy their wants by production and exchange. It assumes that humans have wants and that these wants diminish in intensity as they are progressively satisfied. Both the existence of wants and the diminution of their intensity with fulfillment appear sound inductive generalizations—valid for the area of application. The mere fact of diversity in individual consumption tends to prove the law of diminishing utility. If the intensity of a want did not decrease with satisfaction, a rational man would consume nothing but the single most satisfying commodity. The individual most clearly acts on the principle of diminishing utility when he participates in a family budget conference, *e.g.*, weighing a

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validity and meaning of most of the traditional assumptions of classic price theory.

J. M. Clark, *Economics of Overhead Costs*, University of Chicago Press, Chicago, 1923, is a particularly powerful presentation of short-run analysis, with all its discontinuities and irreversibles.

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Robert Triffin, *Monopolistic Competition and General Equilibrium Theory*, Harvard University Press, Cambridge, Mass., 1940, contends that there are no industries and that the assumptions of monopolistic competition are irreconcilable with a determinant general equilibrium.

<sup>2</sup> W. A. Paton, *Accounting Theory*, The Ronald Press Company, New York, 1922, presents a list of assumptions in Chap. 20 on the Postulates of Accounting.

C. R. Rorem presents a similar list in Chap. 22 of *Accounting Method*, 2d ed., University of Chicago Press, Chicago, 1930.

H. A. Finney, *Accounting Principles and Practice*, Vol. 1, pp. 112–120, Prentice-Hall, Inc., New York, 1934, contains a list of accounting principles that have somewhat the force of postulates or premises.

The executive committee of the American Accounting Association issued a statement of "Accounting Principles Underlying Corporate Financial Statements," which is, in part at least, an attempt to state premises. See January, 1942, issue



marginal movie against a holiday turkey. A branch of economics, consumer economics, studies these wants and the resulting patterns of consumption for various income, ethnic, and geographic groups.

Management also assumes the existence of consumer wants and directs market researches to determine their character, intensity, and distribution. Management recognizes the phenomenon of diminishing utility when it considers reducing prices to stimulate volume. Evidently the assumption of wants characterized by diminishing utility is a workable hypothesis for economics, management, and individual consumer.

Economic theory further assumes that these wants are relatively stable, that consumption patterns tend to persist. This is approximately true from a social point of view, less true from the perspective of management, and notably false from the standpoint of an individual. Individual wants change with age: dolls, bicycles, diamonds, furniture. From the enterprise and social perspectives, these changes largely cancel because the age composition of the market or society does not change rapidly. Style innovations and technical inventions change enough individual consumption patterns simultaneously to have cataclysmic effect on the most closely related industries, *e.g.*, women's clothing and mechanical refrigeration. Yet from the point of view of social theory, the area affected by such changes may be so relatively small as to be inconsequential.

### *Knowledge and Reason*

"... the accountant, like the economist, postulates a world full of rational businessmen. He assumes that every exchange is fair, that

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of *Accounting Review*, whole issue. See also Paton and Littleton, *An Introduction to Corporate Accounting Standards*, American Accounting Association, 1941.

C. R. Rorem, *Accounting Method*, Chap. 39, contains a brief discussion of marginal costs in accounting, and the volume contains an excellent problem involving marginal costs.

W. Vatter's concluding chapter on Re-examination of Cost Accounting in Neuner's *Cost Accounting*, Business Publications, Inc., Chicago, 1938, contains some discussion and several illustrations of the role of differential costs in accounting.

C. R. Rorem, "Differential Costs," *Accounting Review*, pp. 333-341, December, 1928, stresses the differential approach to problems of formulation of business policies.

The *Syllabus in Accounting*, University of Chicago Press, Chicago, 1935, contains many subversive questions hinting at the importance of marginal and sunk costs in accounting analysis.

buyer and seller are in every case equally informed and equally gifted in ability to trade . . . coercion, fraud, bad judgment, carelessness—all these factors are in general assumed to be entirely absent from business transactions.”<sup>3</sup> Like the perfect straight line to the geometrician, to the economist the assumption that buyers and sellers know the facts and act logically is probably a necessary simplification, enabling development of a theory of economic relationships. The assumption embodies a measure of truth, and its inaccuracies may largely cancel in the area and period of applicability contemplated by the economist.

In the restricted area and period of accountant and manager, errors assume greater significance and are less likely to offset each other in any substantial degree. Some insist that the assumption holds only for purposes of initial entry, that assets may subsequently be revalued to eliminate errors.<sup>4</sup> Both in precept and in practice, accountants resist revaluation, upholding the assumption of knowledge and reasonableness even where it is known to be in error.<sup>5</sup>

If the assumption is not made, it would still appear necessary to maintain a record of the price actually paid, informed or ignorant, free or coerced. Important as this valuation is, historical cost is not the sole important valuation for managerial purposes. Consequently in this study the assumption that businessmen know all the facts and reason perfectly will not be made. All evidence as to values in terms of objectives, situations, and problems will be admissible, and valuations employed will explicitly contain a large element of managerial judgment. This much reasonable behavior is assumed: that men try to acquire maximum satisfactions with minimum outlays. From the point of view of industrial management, this can be restated as in Chapter 2: management seeks maximum net revenues for distribution among the pressure groups.

<sup>3</sup> Paton, *op. cit.*, p. 489.

<sup>4</sup> C. R. Rorem, *Accounting Method*, 2d ed., p. 290, University of Chicago Press, Chicago, 1930.

<sup>5</sup> DR Scott, “The Tentative Statement of Principles,” *Accounting Review*, p. 298, September, 1937: “The first point in the tentative statement of principles reflects a dominance of the record function of accounts. Its emphasis upon historical cost is so literal that it precludes even the correction of an earlier historical cost for identical assets unless the later cost happens to be the lower. If the later cost is higher, both stand as authoritative in spite of their inconsistency.”

## PRODUCTIVE RESOURCES

*Cost in Managerial Accounting*

As the term is used here, *cost* includes all dissipation of factors of production owned, controlled, or paid for by the enterprise. *Dissipation* is used broadly to include all real reductions in productive factors whether due to consumption, exchange, accident, obsolescence, mistake, weathering, or mere passage of time. Thus we may speak of the "cost" of a product ready for sale or at any stage of processing or of a process or of a department or of an asset or of a mistake or an accident. *Real cost* will refer to dissipation of the productive factors themselves—the expenditure of labor time or effort, the using up of materials, or the wearing out of machinery—and consequently is an aggregate of dissimilars. *Exchange cost* will refer to exchange values of real costs. *Historical cost* will refer to money outlays originally made to obtain the productive factors comprising real costs. Thus historical cost is an *original cost* valuation of real costs, while exchange cost is sometimes a *replacement cost* and sometimes a *resale price* valuation of real costs.

The amounts of want-satisfying goods available are sharply limited. As a consequence, their marginal utilities are great enough to cause production in spite of the sacrifice involved: either human effort or abstinence or the using up of natural resources otherwise available for other purposes. Increased output of any commodity requires use of increased amounts of productive energies, obtainable, in general, only by diversion from production of other commodities. This economic concept of *opportunity costs* plays a fundamental role in the managerial approach to accounting.

Physical agents of production are purchased in bundles. The price paid for a bundle depends upon the size of bundle, time of purchase, and many other factors. Typically, half a bundle will cost more or less than half as much as a whole bundle. Indeed, many purchase bundles are practically indivisible marketing units. After acquisition, these purchase units are physically divided into use units. For example, a machine is purchased outright and used by the hour, now on one product, now on another. Or a building is rented for a year and used foot by foot, hour by hour, for production of a considerable variety of items and under many conditions of demand. Production results in new and sometimes novel combinations of these use units.

The resulting sale units rarely contain any whole purchase units, let alone consist wholly of such units.

The process of acquisition, division, use, recombination, and sale of productive energy is a cumulative sequence of cost incurrence. We may attempt to accumulate costs to any point of this sequence in an attempt to find the costs of parts, jobs, or products. We may attempt to assign costs to particular processes or operations within the sequence. Two major considerations are basic to useful compilation of such accounting data: (1) What is the *ultimate* purpose of gathering such data, and (2) what is the nature of cost?

In Chapter 2, the major managerial functions were found to be planning and control of operations with a view to achieving economic efficiency. Consequently, the ultimate purpose must be found in managerial needs for data as a basis for planning or control. Both planning and control depend upon analysis of change. In planning, the typical analysis runs as follows: If this *change* is made in plans, what *changes* in costs, incomes, and profits are likely to result? In control, the analysis runs in terms of the ability of subordinates *to cause changes* in costs and incomes. Managerial accounting must run in terms of cost and income aspects of intended or controllable changes. Thus the nature of cost involves two successive questions: (1) How do real costs change, and (2) how are exchange costs related to real costs? The result is a calculus of incremental costs and incomes characteristic of managerial accounting, in contrast to the averages characteristic of traditional accounting and costing.

### *Mobility of Productive Resources*

Managerial ability to cause and control change depends upon the transferability or mobility of productive agents. The transferability of factors of production from place to place and from industry to industry has long been debated.<sup>6</sup> An assumption of perfect mobility is conveniently simple and may be true enough over the area and period contemplated by general equilibrium theory. New supply of capital and labor can be directed to the highest bidding industry before they take specialized form. There is usually a mobile fringe that will adequately satisfy many of the needs of equilibrium theory. In the long run, transfers are made, equilibrium is achieved, and all costs may be properly regarded as variables.

<sup>6</sup> L. C. Marshall, *Readings in Industrial Society*, 2d ed., pp. 1637ff., University of Chicago Press, Chicago, 1930.

Some existing specialized capital and labor are transferable only by process of exhaustion and replacement. These are described by the expression *sunk costs*, and they play a major role in the managerial use of accounting data. These nontransferable items may be small and transient to the point of insignificance from a social point of view and yet may be fatally large from the perspective of an enterprise. A transferable margin may be sufficient to make general economic theory substantially true, but the nontransferable residue is a major problem of management. Rapid transferability without loss would eliminate managerial problems associated with obsolete and idle equipment and personnel problems growing out of a need for highly specialized labor. In unusually uncertain periods, management endeavors to keep capital in as liquid condition as possible, using more labor (which can be laid off) and less laborsaving equipment, and is more reluctant to embark on new ventures, especially if they require fixed forms of capital, which may be difficult to withdraw.

The physical nature of some factors of production prohibits mobility, while others are highly mobile, shifting from job to job, enterprise to enterprise, or even industry to industry easily and with little loss. The enterprise typically buys the necessary factors for money. Just before such purchase, corporate capital is in a liquid, uncommitted form allowing a high degree of freedom of action. The capital of industrial enterprises passes through a series of concomitant cycles, from cash to physical properties and labor, which are used to produce physical products, which are sold for cash, after which the cycles repeat indefinitely. The concomitant cycles are of different periods and divide, intertwine, and recombine in varying patterns. In some phases of some cycles capital is committed; it cannot vary, it cannot change, it must pass on into the next phase or be lost.

#### *Fixed and Variable Costs*

*Fixed* costs are constant, cannot change; whereas *variable* costs can be changed by managerial planning or diligence. *Sunk* costs are a special type of fixed cost—they are fixed along all dimensions of all managerial problems until their cycle runs out and time for replacement arrives. Some costs, *e.g.*, organization expenses, have a cycle identical with the life span of the enterprise and are consequently permanently sunk. Other productive factors are more mobile, less specialized or move in short cycles and are consequently subject to more frequent or even continuous adjustment and control. The dissi-

pation of these factors is recognized by managers, economists, and accountants as variable costs.

Three premises describe the attitude of managerial accounting toward classification of costs as fixed or variable:

1. The division depends upon the dimension or dimensions of the managerial problem under consideration.
2. The division is not absolute. Fixed costs are relatively, not absolutely, fixed, and variable are relatively, not absolutely, variable.
3. The division depends upon the span of anticipation.

*Dependence upon dimension.* *Fixed* and *variable* are partly a matter of dimension. The division of costs into relatively fixed and relatively variable with respect to one managerial problem, say optimum output, does not hold for another problem, such as determination of variety of product to be offered or for selection of processes to be performed. Yet another variable group are those responding to managerial diligence as compared with those fixed beyond executive ability to change. The division depends upon situation dimensions as well as upon purpose dimensions. In Chapter 6, situations are presented in which direct labor is a fixed cost and other situations in which it is variable. This multiplicity of dimensions has not been generally recognized in accounting and budgetary literature. As a result, little or nothing has been done with the implications of managerial problems as to the relevancy of various dimensions or with the dependence of the division between fixed and variable upon the shifting relevancy of the dimensions as different managerial problems come under consideration.

*Relative nature of classification.* *Fixed* has usually been regarded as too fixed, and *variable* as too variable. The failure of fixed to remain absolutely constant and of variable to maintain strict proportionality is clearly disclosed by brief analysis of cost changes associated with expanding output.

From a short-run enterprise perspective, some productive agencies are more easily expanded or transferred than others. The proportions are not fixed. The production of a commodity can be increased by expanding or transferring some agencies even though others remain unaltered. As the amount of any productive factor devoted to a commodity is progressively increased, the amount of commodity produced also increases, but at a decreasing rate, until a limiting value is approached beyond which increased output is possible only by increasing other factors of production. For example, output can be increased by adding labor without adding to capital. Instead of allowing machines to stand idle while operators get materials, more men may be

employed. Flying squadrons may be developed to fill in for absentees and so maintain heavier load factors on capital. Maintenance and repairs may be relegated to nights or holidays. Overtime or extra shifts may be employed. But each successive equal increment of output is obtained by progressively larger increments of labor cost. Long-run average cost is more nearly constant but ultimately rises at an increasing rate owing to greater costs of coordination and perhaps to greater opportunity costs as factors are bid away from progressively more urgent competitive uses.

Both the persistence of scarcity and the "law of decreasing returns" appear to be sound inductive generalizations applicable to the whole area of economic theory, of management, and of accounting. Where the change in production volume is small and the period short, it may suffice to regard factors relatively hard to transfer as absolutely fixed, and readily transferable factors as being in direct proportion to output.<sup>7</sup> Occasions do occur in which the error of this simple assumption becomes serious and significant mistakes in management result. For example, if management is concerned with the problem of optimum output, either in the short run or long run, it must conceive of unit costs first falling and then rising as output expands. If the accountant's customary assumption of a linear relationship is made, the problem of optimum output has no meaning, and management seeks ever larger output in defiance of the laws of diminishing utility and decreasing return.

*Dependence on time.* Economists have long known that the division of cost into fixed and variable is contingent upon the length of view adopted. "All costs are variable in the long run." And all are fixed if a short enough view is adopted. Cost accounting texts and systems and variable budget literature and installations do not appear to have reached this level of sophistication as yet. Only a minority of managers and accountants seem to have discovered the desirability of maintaining sales volumes during off-peak and depression periods by pricing on a basis of variable cost plus whatever fixed cost can be recovered. Some of these enlightened men have learned the lesson too well and do not appreciate the long-run need for prices high enough to provide for replacing "fixed" factors of production.<sup>8</sup>

This study assumes that some costs are more subject to change and control than others (some are relatively variable, others relatively

<sup>7</sup> Typical is the "profitgraph," or flexible budget, on p. 99 of Alford's *Cost and Production Handbook*, The Ronald Press Company, New York, 1934.

<sup>8</sup> Ross G. Walker, S.A.M. annual meeting, December, 1941.

fixed) and that more cost factors are subject to change and control over longer periods and fewer over shorter periods. Among the great variety of managerial problems of planning and control, some are concerned with the immediate future only, while other problems pertain to much more remote operations. As a result, management must be interested both in the division of costs between fixed and variable and in the shifting of this division as the time span considered lengthens.

### *Relation of Exchange Costs to Real Costs*

We turn now from consideration of real costs to that of exchange costs—the present market values of real costs. Behavior patterns of exchange costs do not parallel those of real costs. Real costs are not proportional to output, and exchange costs are not proportional to real costs. Physical factors are acquired in bundles, which are divided for use. Exchange values do not divide in the same way. If an enterprise acquires a carload of material at a given cost, it does not follow from a managerial point of view that one-half a carload costs one-half as much or that both halves (though physically indistinguishable) have the same value. In many instances, quantity discounts are given at the carload level. An enterprise needing half a carload badly enough to pay the l.c.l. price may need the other half enough to justify paying the *extra* cost of the full carload but not enough to justify paying half the cost of a full carload. Overtime premiums play similar tricks on the oversimplified arithmetic of traditional accounting.

Further intricate value relationships arise out of the facts of joint incomes and costs—phenomena much more prevalent than is usually recognized. Purchase of improved real estate or of an entire business enterprise gives rise to all the difficulties inherent in the effort to divide the cost of a cow between the hide and the carcass. Nor does an elaborate bargain between buyer and seller, setting values on each separate component, settle the problem. Assume that Smith asks \$10,000 for a lot and \$20,000 for the building on it. Jones thinks the lot worth \$5,000 and the building \$30,000 and quickly agrees to both Smith's valuations in order to consummate the bargain. Jones's public accountants typically will not approve Jones's valuations and should not (but do) accept Smith's valuation of the land.<sup>9</sup> Smith's joint income raises similar problems in his accounting records. Such problems are further complicated by the conventional writing off of

<sup>9</sup> Finney, *Principles of Accounting*, Vol. 2, p. 39, Prentice-Hall, Inc., New York, 1934.



buildings through the depreciation accounts, while land is assumed not to depreciate and consequently is held on the books indefinitely at original cost.

Finally, items purchased together may be used at different times. Thus carrying charges, accumulated until time of use, differ. Presumably the cost of the bundle purchased is sufficiently less than the aggregate cost of the fragments purchased separately more than to offset the carrying charges, which accumulate until the last piece is used. Fluctuating load factors also make units used at one time worth more or less than units used at another. For example, holiday hours of occupancy of a factory building may be worth less than operating hours.

The whole problem of the behavior of real and exchange costs and incomes is extremely complex. Here it is sufficient to state explicitly that this study rejects the customary assumptions and practices of accountants in this matter. The actual behavior of these costs and incomes will be analyzed in considerable detail in Chapter 6 on Increments and Opportunities.

#### RULES OF THE GAME

##### *A Legal System*

This study assumes that a legal system facilitating and limiting economic behavior exists and that the state maintains police and courts to enforce the rules of economic relationships embodied in this system. For present purposes the details of the system and its enforcement are not important, but there must be a set of rules and the rules must be enforced. The rules of 1800, of 1900, or of 1950 are equally serviceable as a basis for a theory of managerial accounting. For example, there may or may not be a rule fixing maximum hours or minimum wages for labor. In either event the theory of management (and therefore of managerial accounting) applies unchanged within whatever area of managerial discretion is allowed, although specific solutions to managerial problems will vary widely in accordance with the differing limits imposed.

In general, the rules are assumed to exclude coercion, except by the state in the course of enforcement of the rules. Thus the manager is not allowed violent solutions to his problems. Murder and arson as devices for controlling competitors, customers, or employees are excluded from the present analysis. Conversely, management is protected from coercion by competitors, customers, or employees. Many detailed exceptions may be permitted without perceptibly weakening

the analysis. Individuals may be given a degree of coercive powers to assist the state in enforcing the rules, *e.g.*, violent ejection of trespassers, rights of self-defense, and other lawful opportunities to act violently. Some slave labor may be permitted, and the master given extensive rights to coerce his human chattels. Laws may be broken, and enforcement may be lax; but if such behavior becomes too prevalent, chaos results and the present analysis will not apply.

### *Private Property*

Private property both in instruments and in fruits of production plays a dual role: as stimulator and as organizer of productive effort. The acquisitive motive guides and stimulates the manager, while ownership of private property makes possible managerial organization and control of production by enabling the manager to offer a material reward for compliance with his orders.

The essence of private property lies in the ability to appropriate—to exclude others in some degree at least. The possibility of private appropriation depends upon the physical nature of the property and upon the state of the arts, the permissibility of appropriation upon custom and law. The precise nature and amount of private property accordingly vary with changing nature, changing technology, changing custom, and changing law. For example, if the nature of a technique is such that it can be kept secret, the technique is appropriable and may remain private property. If it cannot be kept secret, the patent law may still render it appropriable and consequently private property.

### *Managerial Discretion*

The essence of individualism is the freedom of the individual to use his private property in any manner he pleases (within broad limits) to improve his own status as he conceives improvement. This study assumes that the rules provide an area of discretion within which management may choose among alternate courses of conduct and a degree of managerial control over some of the agents of production and some of the product. The extent of discretionary area or of degree of control permitted will greatly influence the plans and conduct of managers but within wide limits will have little effect upon the theory of management. In an analogous way, public officials exercise a degree of discretionary control over public properties. In this respect, public management does not differ greatly from private.

The individual pursuit of self-selected goals often requires control of property. Managerial control of property within an area of discretion makes possible the offer by management of a *quid pro quo* for the services of labor or other owned productive agents. Since the owners of these agents have goals of their own that may require control of other forms of property, management is able to buy their voluntary cooperation. Thus private property becomes one of the great organizing devices of society.

### *Competition*

Certain types of competition are assumed and appear to be characteristic of present and all likely future societies. Alternate plans of conduct may be regarded as competing for managerial favor. Products (or, in a more ultimate sense, consumers) compete with one another for the services of productive agents. Units of productive energy compete among themselves for assignment to the more lucrative or otherwise more desirable jobs. These competitions provide a role of arbiter for management under almost any conceivable social organization. As one of the productive agents, managers compete among themselves for preferred positions.

### *Enforceable Contracts*

The above assumptions appear to be accurate partial descriptions of present society or of any conceivable technological society. One further assumption as to the rules of the game is made. It is less general, having specific reference to present capitalistic society. We assume that the rules of the game provide for the exchange of promises or of a promise for an act and for the subsequent execution of such promises under penalty of payment for damages resulting from breach of contract. If our managerial accounting is to make "full disclosure" of financial condition, it must show *all* unexecuted enforceable contracts on its reports. Traditional accounting has seriously limited the usefulness of its financial statements by omitting several classes of legal liabilities. The most common of these omitted but legally enforceable obligations are sales commitments, interest not yet accrued but promised under enforceable contracts, and obligations assumed under a valid lease. Obviously, corresponding assets—right to receive payment, right to use money, right to occupy premises—which are also omitted, should be set forth in statements prepared in accordance with the theory of managerial accounting.

## NATURE OF THE ENTERPRISE

*Definition*

Modern society is characterized by extreme specialization of the agents of production. An optimum allocation of these specialized agents is approximated by means of three methods of coordination: by bargaining (more or less free exchange), by managerial authority, and by "rationing."<sup>10</sup> Typically, coordination within an enterprise is accomplished through exercise of managerial authority and coordination among enterprises by the striking of bargains in the market place. Whatever may be true from a legal or a financial point of view, the type of coordination defines the scope of the enterprise as seen by its management. From the managerial point of view, the enterprise extends as far as the authority of its management and ends where bargaining begins. Thus, when an employee enters the manager's office to demand an increase in wages, he acts as a separate, independent enterprise, an entrepreneur in his own right. When he enters the manager's office to receive instructions, he acts as a part of the enterprise. Since negotiations for a change in wages may continue while operations are in progress, it is possible for a workman to occupy both statuses concurrently.

*Bargaining Transactions*

In modern society, nearly all exchanges take place in terms of money; *i.e.*, money is exchanged for goods or services. In many bargains there are secondary, nonmonetary considerations, and a few transactions of a wholly barter nature take place. In general, the analysis will assume that the enterprise pays money for the materials, labor, equipment, and other productive agents it buys and receives money in exchange for the products or services it sells. In neither purchase nor sale is it necessary that the payment of money be simultaneous with the delivery of goods or services. The transfer of money may precede, accompany, or follow delivery of goods or services.

Buyers will not offer more money than they believe goods are worth, and sellers will not accept less money than they believe goods are worth. To the extent that markets are free and buyers and sellers informed and intelligent, goods tend to be worth about what they cost. In any event, the money paid for goods is an important fact in the financial history of the enterprise. This leads to traditional accounting

<sup>10</sup> John R. Commons distinguished three types of "transactions": bargaining, managerial, and rationing. See "Institutional Economics," *American Economic Review*, pp. 648-657, December, 1931.

and managerial accounting recording the transaction in terms of the amount of money involved. The typical entry takes the following form:

Acquired: goods (costing us)..... \$40  
In exchange for: cash..... \$40

or

Acquired: cash..... \$40  
In exchange for: goods (bringing us)..... \$40

Barter transactions are reduced to estimated pecuniary magnitudes. Many secondary, nonmonetary considerations are omitted from accounting records, *e.g.*, seniority rights.

Private enterprises buy, fabricate, and sell with a view to receiving more money than they pay out, the excess eventually being distributed to the owners. Public or socialistic industries seek to maximize social income and to minimize social costs, *i.e.*, to increase net social benefits. Considering the physical variety of real income and real costs, some system of weighting and aggregating is necessary in social as well as in private enterprise accounting. This system must be constructed in terms of comparative economic values based on relative demands and scarcity. Such a system, whether coupled with private or with public enterprise, is a price system. If value calculations are carefully and accurately made, either private or public management should seek to maximize net income.

### *Enterprise Operations (Managerial Transactions)*

Activities directed toward securing a maximum net income are almost as varied as life itself. They vary from time to time, industry to industry, enterprise to enterprise, department to department, and job to job. Taking the enterprise as the unit under a single managerial control, we can classify activities performed by the enterprise according to departments and subclassify them according to divisions, or jobs. Since the organizational pattern varies from company to company, we shall describe a hypothetical manufacturing business designed to bring certain types of activities into bold relief. Figure 1 shows an organization chart for such a business. Reporting to the president are department heads in charge of (1) research (creative originality), (2) procurement (getting internal things done), (3) distribution (getting external things done), (4) planning (thoughtful, flexible compromising), (5) control (meticulous adherence to rules).

This classification is based largely on the kind of mental processes required, on character traits, rather than on a basis of similarity of

informational background required. Thus, research requires a curious, open-minded originality. Procurement calls for the executive, but the man of action in procurement operates inside the enterprise, dealing with familiar things in a familiar environment. Distribution also calls for a go-getter who gets things done, but these people operate outside the enterprise, dealing largely with strangers in an ever-shifting unfamiliar atmosphere. Planning calls for thoughtful, flexible com-

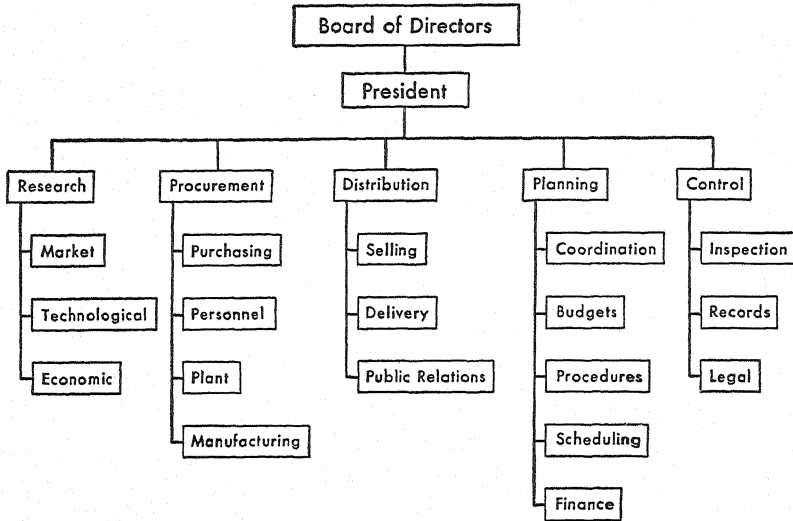


Fig. 1. Organization chart of a hypothetical manufacturing company.

promising. It requires no great originality, nor does it need the hard-hitting man of action. It calls for the kind of thought that glories in putting things together, that always seeks the optimum compromise. Control, as here used, requires the precise mentality that thinks in terms of strict conformance to established rules.

Each of these departments based on character traits can be subdivided into divisions based largely on knowledge or training. An outline of the divisions and their general duties will materially sharpen the picture of what a manufacturing enterprise is and does.

*Research.* The major divisions comprising the research department have to do with (1) market research, (2) technological research, and (3) economic research. The market research division makes field surveys and studies published data to discover the types of product in demand (styles, colors, gadgets, etc.), the amount that can be sold at various price ranges, the geographic and economic distribution of

prospective customers, the uses various classes of customers make of the product, and the effectiveness of various methods of reaching the market.

The technological research division works in laboratory and field to develop new products, improvements on existing products, improvements in methods and processes, better locations, new or improved plant layouts, and better equipment. In general, it does all work requiring a research attitude and technical training.

The economic research division is concerned with discovering fundamental economic trends and predicting their effects on the operations of the company. This includes studies of business cycles, of price levels, and of trends in customer industries and in sources of supply.

In general, divisions of the research department make investigations and report the data developed to other departments. The research department is expected to interpret data and make recommendations. It is a "staff," or advisory, function and has no authority to force other departments to act upon its suggestions.

*Procurement.* The procurement department consists of the following divisions: (1) purchasing, (2) personnel, (3) plant, and (4) manufacturing. The purchasing division of the procurement department locates possible sources of materials, parts, and supplies. It translates manufacturing requirements into the customary specifications of the trade. It balances quality and services against prices offered by rival suppliers and thus selects vendors from whom goods will be purchased. It makes contracts to assure that proper kinds and qualities of goods arrive in adequate quantities at the times they are needed for production.

The personnel division of the procurement department locates, selects, and trains new personnel. It supervises compensation, promotion, and transfer of employees. It conducts negotiations with employee associations. And it has charge of any employee services undertaken by the company.

The plant division of the procurement department selects, installs, and maintains machinery and equipment. Plant construction and maintenance and toolroom are parts of this division. Also the division provides for cleaning and painting and for power, steam, water, and compressed air.

The manufacturing division does all processing of products. It is responsible for setup and operation of all direct-processing equipment. Because of the intimacy of relationship, the manufacturing division usually has charge of materials handling and frequently of stores.

In general, procurement departments buy, manipulate, and assemble anything necessary to provide products ready to sell.

*Distribution.* The distribution department includes the sales, delivery, and public relations divisions. The sales division determines the appeals to be made to prospective customers and selects media to carry the appeals effectively and economically. It directs a corps of salesmen following up advertising and making the actual sales. It handles customer installations and service and takes care of complaints and adjustments.

The delivery division supervises packing, shipping, warehousing, and trucking activities.

The public relations division has been included in the distribution department because its technique is essentially akin to that of advertising and selling. Moreover, customers form a large segment of the public and receive most of their impressions of the company from contacts with sales division personnel. Good public relations helps to forestall labor troubles, adverse legislation, monopoly investigations, and other increasingly prevalent social difficulties of private enterprise.

In general, the distribution department has to do with getting customers and keeping them satisfied by courteous treatment, prompt deliveries, fair handling of complaints and adjustments, institutional advertising, and such other methods as may apply.

*Planning.* The planning department specializes in coordination. After the research department has developed a new product, the planning department works out the range of sizes, styles, prices, and colors, compromising between requirements of the market and those of the factory. The sales department usually desires a large selection to present to prospective buyers, while the procurement department is all for a high degree of standardization and a sharply limited line to minimize costs of procurement. A design committee may be set up consisting of representatives of research, procurement, distribution, and planning departments, with the planning department directing the committee's efforts toward a compromise acceptable to all.

Budgets, in their inception, are planning devices compiled under supervision of the planning department. Budgets can be set up for each of many alternate plans of conduct, and the most satisfactory plan chosen by comparing the estimated balance sheets and income statements associated with the several plans. Coordination among departments is largely secured by fitting each department's plan of action into the same general budget. Thus changes in one depart-



ment's plans are carried through the budget mechanism into the plans of all other departments. By this means, departmental executives gain an insight into the interrelationships among departments and learn why plans must be made to operate as planned. Activities conducted in accordance with such plans are coordinated because the plans themselves have been coordinated through the operation of the budgetary machinery.

Procedures are another coordinating device and consequently are under the authority of the planning department. They provide for gathering data by departments in contact with developments and transmission of these data to other departments needing the information as a basis of effective behavior. By means of this flow of reports and compilation of records, activities of various departments are articulated and directed toward a common goal. The sales division, for example, fills out an order form at the time of sale and sends a copy to the manufacturing division. This enables the manufacturing division to produce the items ordered, thus pointing the efforts of the two divisions toward a common goal. To be most effective, procedures governing the compilation of records and the design and routing of orders and reports should be centrally designed and supervised. This function is located in the procedures division of the planning department.

The planning department is also responsible for scheduling. This involves compromises between the sales division's desire for immediate service to customers, the finance division's desire for minimum investment in inventory, and the procurement department's desire for long runs to reduce setup costs and to obtain quantity discounts. Modern production control systems tie sales budgets and shop schedules into a single coordinated plan. If scheduling were under either procurement or distribution, friction would result because of the strong tendency to play favorites under such circumstances. If scheduling is made independent and part of the work of a compromising, coordinating department, this danger is minimized.

Finance, in a going business, is largely a matter of arranging to finance leads or lags between procurement and distribution. When procurement and distribution are coordinated in the budget and scheduling divisions, the need for funds is revealed and arrangements for financing can be made. Longer term financing may be necessitated by developments in the research department or by decision of the board of directors. Even in such instances, plans should be reduced to budget form through cooperation of all departments or divisions affected, and such a budget will indicate the precise extent to which financing is necessary.

*Control.* Controlling, as here used, means the meticulous following and enforcing of rules. The rules are typically set by committees or by other departments or divisions. Thus product standards may be set by a design committee composed of representatives of the research, procurement, and distribution departments meeting under leadership of the planning department. But after adoption, these standards are enforced by the inspection division of the control department. This enables inspectors to work independently, free from pressures to tighten or to loosen standards. The rules have been set; the inspection division merely requires exact conformity.

Similarly, a budget committee consisting of all the major executives meets under the leadership of the planning department. This committee adopts the budget. It then becomes the responsibility of the accounting division to enforce it. This entails keeping adequate records and preparing reports periodically, showing how closely each department and division has followed the plans specified in the budget. The accounting (or records) division exercises no great discretionary powers. It merely follows and enforces rules previously agreed upon.

Under present conditions, an enterprise must conform to many laws and bureaucratic administrative regulations. The legal division, supported by the records division, is responsible for submitting all reports required by law and otherwise seeing that the enterprise conforms to various legal requirements imposed by government.

*Administration.* The board of directors and general administrative officers of a business retain certain functions. They formulate the broader policies—either those which affect several departments or those too important to be decided by executives on lower levels of authority and responsibility. They determine the major groupings of activities—commodity, functional, or territorial. They determine the authoritative relationships among major activity groups. They select, promote, transfer, and dismiss major executive personnel. They retain legal counsel, public auditors, professional engineers, and management consultants. Also they assist in performing activities of especial importance, such as closing unusually large sales or arranging particularly important financial relationships.

## CHANGE

### *Extra-economic Change*

Neoclassical price theory is an equilibrium economics. It assumes an equilibrium disturbed by a single extra-economic change. It an-

alyzes the forces and traces the steps by which a new equilibrium is approached. It abstracts from all other extra-economic changes. Specifically, it abstracts from changing wants, changing technology, changing natural resources, changing law and evolving institutions, and war and acts of God. These are regarded as extra-economic forces, relegated to other disciplines, such as psychology, engineering, law, sociology, history, and political science.

Management cannot choose its problems in this manner. It cannot say, "Here are the forces we choose to study; here are other forces we will deliberately ignore, leaving them for others to study." Its problems are dictated by the environment of the profit-seeking enterprise that management directs. If styles change, management must recognize and comply with the changing patterns of customer demand. Insensitiveness in this respect results in bankruptcy. The invention of new products produces changes in want patterns as profound as and usually more enduring than those caused by fads or styles. Management must operate its enterprise in such a way as to meet these changing demands, to benefit from them if possible, and perhaps even to initiate new styles or to develop new products.

Similar managerial problems occur on the supply side. Changing technology introduces new products and new processes, which management must be quick to evaluate and adopt. The discovery of new sources of raw materials or the exhaustion of old deposits generates location, transportation, and substitution problems with which management must cope. Nor must management remain passive while these problems arise. It may take the lead in research and exploration to discover new techniques, new materials, or new sources of old materials.

Furthermore, the social and physical matrix in which the enterprise functions is subject to change. Law, institutions, and customs evolve and so change the terms in which managerial problems are written. War comes and goes; floods, fires, and storms change the nature of management's problems even while they are in process of solution and create never-ending needs for new adjustments.

Broad and deep as is this stream of change, much remains static—enough so that economic abstraction from the change aspect of reality does not wholly vitiate economic analysis and conclusions. Much of the new merely replaces a somewhat similar old, as the automobile replaced the buggy, without changing fundamental economic processes of specialization and coordination through marketing. Much change is slow enough to allow adjustment to keep pace. Other changes, spec-

tacular enough when judged by the industry scale, become incidental and unimportant when measured against the social aggregate of all industry.

But management operates on the industry scale. If it is in a relatively stagnant industry, the static assumption does no harm. If management operates in a new or rejuvenated field, change may be so omnipresent that any assumption carrying a flavor of the static must be barred. As usual, accounting must tag along with management on pain of losing relevancy. For managerial purposes, reasonably frequent appraisals must necessarily supplement historical cost data. Otherwise accounting may continue to serve its legal purposes but fail in the managerial.

### *Constant Value of Money*

As a general rule, American accountants ignore changes in price levels.<sup>11</sup> An assumption that money has a constant value seems not near enough the truth. For managerial purposes, substantial adjustments should be made before certain accounting data are taken too seriously. For some managerial purposes, the thorough adjustments proposed by Sweeney may be necessary. In other circumstances, placing fixed assets and their corresponding depreciation expenses on a current replacement basis may be sufficient.<sup>12</sup>

The assumption is oversimplified even for the area and period of economic analysis, and economists do not fall into this error. In the restricted field of accounting and management, the assumption becomes so poor a fit as to cause great mischief. During periods of rapidly rising prices, every turnover includes a nominal profit due to the falling value of the dollar. This appears as a realized profit in accounting records, something that makes possible legal payment of dividends.

<sup>11</sup> Paton, *Accounting Theory*, p. 488. Rorem, *Accounting Method*, p. 290, 1930. Sweeney, *Stabilized Accounting*, Harper & Brothers, New York, 1936. MacNeal, *Truth in Accounting*, University of Pennsylvania Press, Philadelphia, 1939. Also articles by Sweeney in the *Accounting Review*: "Maintenance of Capital," Vol. 5, No. 4, December, 1930; "Capital," Vol. 8, No. 3, September, 1933; "Techniques of Stabilized Accounting," Vol. 10, No. 2, June, 1935; "How Inflation Affects Balance Sheets," Vol. 9, No. 4, December, 1939. And articles by MacNeal in *The Nation*: "What's Wrong with Accounting," Vol. 149, No. 15, Oct. 7, 1939; Vol. 149, No. 16, Oct. 14, 1939; "Caveat Investor," Vol. 152, Feb. 8, 1941. Paton and Rorem merely state the assumption; Sweeney and MacNeal condemn it.

<sup>12</sup> See, for example, Specthrie, *Industrial Accounting*, Chap. 26, Prentice-Hall, Inc., New York, 1942.

Moreover, assets, stated at original cost minus depreciation,<sup>13</sup> are carried on the books below their current values. The manager, charged by his stockholders with making a reasonable return on investment, finds his profits overstated because of a rising price level and concurrently finds the investment undervalued for the same reason. Profits are divided by investment to find the rate of return. The errors multiply, and the rate of return appears magnificent. The stockholders, managers, law, and public are all deceived by the self-deception of the accountant. The managers receive unearned profit-sharing bonuses, a period of *laissez faire* develops, and business managers are elected to public office.

A period of falling prices follows, and all the above phenomena are reversed. Every turnover involves an apparent loss because dollars are increasing in value. Real assets—land, building, machinery, and inventory—may increase in amount and quality; quick assets may be smaller in dollar amounts but buy more; still a loss appears on the operating statement. Meanwhile, fixed assets added at the peak of the price cycle are carried at original cost minus depreciation, gross overvaluations in the face of depressed conditions. Again the errors multiply, deceiving stockholders, managers, accountants, and public. Managements are turned out, and a period of intense governmental regulation of private enterprise ensues.

These errors are almost omnipresent. Comparative financial statements are drawn without adjustment for changes in price levels and with the plain implication that successive years shown in adjacent columns are truly comparable. Accountants usually date appraisal values when these are shown on the balance sheet. They do not usually date original cost valuations—as though such values were immutable. Naturally, not all assets can carry their acquisition dates on the balance sheet. But if there is any point in showing the fixed asset item at all, it would seem imperative that dates of each major acquisition should be shown.

#### RELATED READING

See footnotes 1 and 2 on pp. 39, 40, and 41.

COMMONS, J. R.: *Institutional Economics*, The Macmillan Company, New York, 1934, utilizes a transaction approach to economic behavior and classifies transactions as bargaining, managerial, and rationing.

<sup>13</sup> See "Statement of Accounting Principles Underlying Corporate Financial Statements" published by the American Accounting Association in June, 1941. There appears to be particularly wide agreement among accounting texts on this point.

- DAVENPORT, H. J.: *Economics of Enterprise*, The Macmillan Company, New York, 1913, contains a lucid explanation of opportunity costs, one of the central concepts upon which Davenport builds his economics.
- GRANT, E. L.: *Principles of Engineering Economy*, The Ronald Press Company, New York, 1938, clearly recognizes the sunk nature of some costs and the fixed nature of others.
- HECKERT, J. B.: *Accounting Systems*, The Ronald Press Company, New York, 1946, develops accounting reports, classifications of accounts, and accounting procedures in terms of managerial needs for data.

## CHAPTER 4

### PLANNING PROBLEMS OF MANAGEMENT

Purposes of the chapter: to investigate the objectives and nature of managerial planning, to explore the variety and structure of managerial plans, and to establish goals for the processes of managerial choice.

Plans alone cannot make an enterprise successful. Action is required; the enterprise must operate. Plans can, however, focus action on purposes. They can forecast which actions will tend toward the ultimate objective of economic efficiency, which tend away, which will likely offset one another, and which are merely irrelevant. Managerial planning attempts to achieve a consistent, coordinated structure of operations focused on desired ends. Without plans, action must become merely random activity, producing nothing but chaos.

Various segments of an enterprise have repeated contacts with the same other economic and social units. Each of these other units also has managers who plan its operations in terms of its environment. These managers are inconvenienced and antagonized and their co-operation lost if the enterprise's contacts lack consistency, either through lack of coordination among its personnel or through vacillation. All points of contact should be coordinated; *e.g.*, advertising, salesmen, product design and quality, packaging, credit arrangements, repair service, and delivery should all be fused into a team conveying a unified impression of quality and service.

The need for temporal coherence was illustrated a few years ago by a merger of two hardware manufacturers, one selling to independent local wholesalers, the other to retailers through factory-owned sales branches. After the merger, the sales branches were favored on both lines. Local wholesalers were antagonized by factory-owned branch competition. Later the consolidation tried to recapture its wholesaler customers. Several of the branches were closed, and their organizations disrupted. When the wholesalers were found lacking in enthusiasm for the company, its policy swung back to distribution through its own sales branches. Meanwhile, retailers had become irritated by the confusion and lack of service. Many had switched to

competing brands and could not be resold by the enterprise of the vacillating distribution policy.

The sequence and timing of events are parts of the master plan formulated by management. Failure in timing may mean congested shop departments, shutdowns, delayed deliveries, excessive carrying charges. Even the managerial activity of planning is itself subject to planning in which sequence and timing are important. For example, a company decided to formalize its compensation structure. Its management analyzed each position as to job content and as to knowledge, skill, responsibility, judgment, and experience required of the job incumbent. The study incidentally revealed much duplication of effort and some activities directed at cross-purposes. A complete procedural analysis was undertaken, which resulted in major changes in assignment of duties to departments and persons. Many job descriptions and analyses were rendered obsolete, and the job analysis and evaluation study had to be repeated.

The broader and more permanent plans, *i.e.*, policies and procedures, reduce management cost by eliminating recurrent decisions. Once a policy or procedure is adopted, recurrent problems are met by automatic, routine application of the rule adopted. For example, a company may work out the economic lot to purchase for each separate item needed. It may later discover that economic purchase lots for castings tend strongly to be approximately 3 months' usage while those for screw machine parts approximate a 6 months' supply. Starting from these facts, investigation may show that the cost of calculating each purchase lot separately is not justified by the minor savings resulting from the precision of separate calculations. A policy of buying 3 months' supply of castings and 6 of screw machine parts loses the minor savings of precision but avoids the costs of recurrent analyses and decisions.

### *Interdependence of Plans*

The plans of an enterprise should constitute an integrated program. Necessarily all current plans of a single management share a common environment. They should all be directed toward a single consistent pattern of objectives. The plans should reinforce one another; they should mesh in an articulated sequence.

Perhaps the best illustration of a complete program of plans, internally consistent and properly articulated, is the budget produced by a well-conceived budgetary procedure. Typically, the sales department



furnishes estimates of sales volumes and selling expenses, both broken down to show component elements. On the basis of these sales estimates, the planning department plans inventories and production. These plans serve as a basis for estimates of purchases of materials, of employment of labor, and of needs for machinery and equipment. These estimates, in turn, supply a basis for forecasting purchasing and employment department activities and thus for estimating the expenses of these two departments. Data concerning machinery needs and aggregate personnel requirements furnish the starting point for calculations of floor space, locker- and washroom facilities, heating, electricity, etc., required to maintain over-all operations. All these plans are reduced to anticipated cash revenues and expenditures, leads and lags are estimated, and a cash budget calculated. Finally, estimated financial statements are prepared. The whole procedure provides a complete, internally consistent, integrated program of enterprise operations.

### *Structure of Managerial Plans*

We have assumed that the ultimate objective of management is economic efficiency, *i.e.*, maximization of the ratio of output to input. This objective is implemented by major policies formulated by stockholders or board of directors. These major policies largely determine the general form of the operating organization, *i.e.*, the division of the enterprise into major departments. Each department head, with some collaboration by his colleagues, with some assistance from his subordinates, and subject to review by president and board of directors, formulates departmental policies directed at carrying out the major policies imposed from above. These departmental policies largely determine departmental organization. Both the processes of policy formulation and of organizational design are repeated on the divisional level and so on down to the terminal operational level.<sup>1</sup> The number, elaborateness, and specific detail of these plans increase rapidly as the operational level is approached. This terminus is represented by a mass of specifications, drawings, dimensions, and standard-practice instructions. Perhaps the penultimate is reached

<sup>1</sup> In a sense, policies are sometimes generated at the operating and first-line supervisory levels and imposed upward. If certain matters are not recognized or provided for by the set of policies adopted, or if regularly adopted policies are not enforced, customs may gradually emerge and achieve the generality, permanence, and authority of true policies.

in motion studies, such as those of surgical operations wherein every motion of each finger is planned and prescribed.

In a large enterprise, the activities of thousands of employees are directed and coordinated by this elaborate hierarchy of plans. A few broad plans are implemented by policies of several levels, and these are supported by a multitude of almost as permanent procedures. The whole governs almost numberless specific detailed decisions. For example, a company is formed to manufacture and sell road machinery (stockholder-level decision). Policies are formulated by the board of directors as to the scope to be given this general plan: Will the company manufacture road scrapers, steam shovels, ditchers, pavement finishers, rollers, snowplows, or sweepers? These decisions are implemented at the departmental level by policies governing the sizes and styles of each line included in the program, materials to be purchased, processes to be performed, and items to be subcontracted. Many procedures are established to carry these plans into action: procedures for handling customers' orders, for routing and scheduling production, for keeping the score of the profit-seeking game. Finally, a multitude of detailed decisions are made within the permanent general frame: should a specific customer order be accepted? Should a particular part be a casting or a forging? Should the company buy a turret lathe or an engine lathe?

The range and variety of plans constituting the elaborate program required by an industrial enterprise will be investigated in the balance of this chapter under the following headings:

1. Policies
2. Organizational configuration
3. Procedures
4. Designs, resources, and methods

## POLICIES

### *Major Policies*

Some policies are considered important enough to be imbedded in the corporate charter or in its by-laws. These can be changed only by vote of its stockholders and are the broadest and most fundamental of corporate policies. Typically, the choice of industry is stated in the purpose clause, and the scale of operations vaguely fixed by the authorized capital structure. The composition and organization of the board of directors is usually stated in the by-laws. Many companies refer other matters to annual stockholders' meetings, *e.g.*,

pension plans, plans for major financing operations, and profit-sharing plans.

Somewhat less significant (or more urgent) plans and choices are made by the board of directors. These policies tend to be company-wide in scope, crossing departmental lines, although a few departmental matters may reach the board through financial importance alone. Choice of industry is perhaps the most fundamental of company policies, underlying and limiting all departmental policies. In its broadest sense, this choice is usually written into the corporate charter and thereby reserved to the stockholders' discretion. However, within these broad limits the board may decide to take on a new line or to discontinue an old one. For example, the board of directors of a manufacturer of plastic firebrick may decide to bring out a line of air-setting materials, or a manufacturer of thermostatic controls may add a line of recording thermometers. The new line presents new problems to sales, production, and finance departments. Prospect lists must be revised with the new products in mind; new sales stories must sing the praises of the new line; perhaps additional sales force will have to be recruited and trained to give the new line effective representation. The engineering department will have to prepare new formulas or new designs. The factory will have to buy new tools, dies, and fixtures and possibly new machinery; radical changes may become necessary in the system of production scheduling and cost control. New financing may be necessary, and credit policies may need revising, as the new line is sold to new types of customers. Both the importance and the interdepartmental character of the change make it a subject for consideration by the board of directors. After its decision is made, all departments will have to revise their policies to conform.

Selection of the competitive level is a similarly all-pervasive issue, properly the prerogative of the board. If the board decides to seek the quality market, the engineering department must specify close tolerances and fine finishes, the purchasing department must buy good materials from dependable sources, the personnel department must hire and train workmen able to produce the desired quality product, the production department must acquire high-grade equipment and provide adequate inspection, the sales department must stress a quality appeal in its advertising copy and in the type of salesperson employed, and the financial department should arrange credit terms appropriate for the quality trade. Every department must orientate its plans and

operations with regard to this major policy imposed by the board of directors.

A third all-pervasive basic set of decisions fixes the company's policy as to venturesomeness, aggressiveness, and expansion. Closely related are policies regarding dilution of stockholders' equity and disposition of earnings. Aggressive expansion suggests extensive borrowing and plowing back of profits. Implications of these policies with respect to departmental plans are too obvious to require detailed comment.

In addition to formulating such fundamental policies, the board coordinates departmental plans through review and approval of the master budgets. This gives the board an opportunity to review departmental plans and ascertain that such plans are designed to implement the broader policies set by the board. Also, the board reviews and approves major expenditures before departments are allowed to proceed with their plans. Later the board compares performance with plans and passes on explanations and new plans growing out of experience with the old.

Within the frame imposed by the board of directors, all departments of whatever type formulate more specific policies to give effect to those set by the board. This will be true whether the major departments follow commodity or functional lines. Thus Chevrolet policies may differ substantially from Cadillac, and both will necessarily differ widely from Frigidaire or Electromotive: the variety of styles and sizes offered, the financing of sales, the channels of distribution will all differ profoundly. General Foods can appeal to coffee lovers with Maxwell House, to coffee haters with Postum, and to limbo with Sanka. Since no two enterprises have the same commodity divisions, commodity departmental policies must be discussed with reference to a specific company. However, many enterprises are divided into substantially similar functional departments, and commodity departments themselves are divided into similar patterns of functional divisions. This affords opportunity to investigate and partially catalogue the wide range of policies formulated by functional departments.

There is considerable variety even among functionally departmentalized enterprises. The organization outlined in Chapter 3 contains practically all frequently encountered functional departments, either as departments or as divisions. It will, therefore, be adopted here as a classifying device, and functional departmental policies will be discussed under the following captions:

1. Research policies
2. Distribution policies
3. Procurement policies
4. Planning policies
5. Control policies

### *Research Policies*

Policies govern the scope of research activities undertaken by an enterprise. Most fundamental is the decision as to fields of research to be included. Three major divisions were suggested in Chapter 3: market research, technological research, and economic research. Enterprises place different emphases upon the three. The attention paid each may vary from elaborate subsidiary corporate organizations spending hundreds of thousands of dollars annually to casual inquiries conducted as a minor side line by an otherwise overburdened executive. Market research may boldly seek new markets or radical innovations in distributive systems or may be confined to testing a few rival slogans on personnel present in the general office. Technological research may rarely include effort in the "pure" sciences, frequently includes a search for strikingly new products or methods, and virtually always involves some effort directed toward minor improvements in existing products and processes. Economic research may be directed toward guiding enterprise reaction to the ebb and flow of the business cycle, or it may seek to throw light on the credit standing of individual customers.

Policies also govern the method of research. An enterprise may adopt a policy of "farming out" certain aspects of its research program to research foundations or to consulting engineers. It may set up an independent research department. Or research may be conducted by advisers attached to the staff of line executives. The approach may be experimental, and sometimes great pains are taken to assure objectivity. Statistical methods employed are improving, but often samples are inadequate or unrepresentative, and techniques of analysis naïve or superficial. Sometimes urgency and economic limitations compel adoption of slapdash methods. More often such methods are the result of technical incompetence of investigator or lack of appreciation of good technique on the part of the "man higher up."

### *Distribution Policies*

Nearly all enterprises have problems as to variety of items to be offered in each product line, location and type of customers to be

sought, and promotional methods to be employed. Other problems of sales policies arise, but these will give sufficient diversity to supply a representative sample. The nature of these problems will be developed in a series of illustrative examples, by no means exhaustive but reasonably representative.

Determination of number of sizes, styles, grades, colors, and finishes to be offered in each product line is usually regarded as primarily a sales matter, although such decisions have terrific impact on procurement plans, methods, and costs. For example, a wire-goods manufacturer was offering 27 varieties of milk-bottle-carrying baskets and similar diversity in each of its other lines. Customers expect prompt deliveries and low prices on standard catalogue items. They expect delay and higher prices on special made-to-order items. Inventory records showed no stock of many items offered in the catalogue. Available space was inadequate to carry stocks of so many items. Production records showed an occasional short run of many items, with much longer runs of a few. Analysis of shipping records showed few or no sales of many items. This, and a comparison of the items offered, indicated that baskets could be cut to five styles and other items in proportion without appreciable reduction in sales volume. This would lower costs by reducing the number of pages and pictures in the catalogue; by reducing the number of welding fixtures constructed, stored, indexed, and maintained; by reducing finished inventories and the associated interest, insurance, and deterioration charges; and by providing fewer and longer production runs with consequent savings on setup costs.

Location of customers to be sought is primarily a sales matter, with substantial production implications. The problem involves balancing sales income from a territory against selling costs incurred to reach the territory plus the incremental costs of producing goods sold there. A Canadian tariff on finished products forced a firebrick manufacturer to reconsider his policy with respect to selling in Canada. Sales records provided a basis for forecasting sales in Canada. Cost records helped in estimating the needed investment and subsequent operating cost of a branch plant in Toronto. The branch was installed, and the investment was recovered in profits on Canadian business in less than a year.

Average size of orders received is an important aspect of selecting the type of customer to be sought. An astonishing proportion of companies have never analyzed their sales with respect to size of order. A jobber of janitor supplies made such an analysis and found nearly

one-half of all orders received were for less than \$5 and nearly one-quarter were for less than \$2. The company's average gross profit was slightly in excess of 30 per cent. It paid salesmen a commission varying from 10 to 20 per cent depending on the items sold. Deliveries were made by a trucking firm at 25 cents per package. Bookkeeping and order-handling costs were analyzed and found to average 60 cents per order. The company tried to improve the situation by eliminating commissions on orders of less than \$2 and by paying half the regular rate on orders of less than \$5. This immediately reduced costs on small orders and produced a marked decrease in the number of such orders. However, the situation continued less than satisfactory. Eventually, the company took on a manufacturing line and gradually dropped jobbed items. This change increased the gross margin and raised the average order from something under \$10 to close to \$60 and the median from approximately \$5 to nearly \$35.

Promotional policies are frequently susceptible to an analytical approach. A furniture manufacturer had a star salesman selling almost exactly one-third of the company's total volume. The company assigned all major cities to its star: Boston, New York, Philadelphia, Washington, Baltimore, Pittsburgh, Cleveland, Detroit, Columbus, Cincinnati, Chicago, St. Louis, Minneapolis, and a few lesser places. Nonmetropolitan areas were assigned along state lines to some 11 other salesmen. The star ran spectacular expense accounts and overdrew his commission account until he owed the company in excess of \$3,000. The company finally felt forced to act. Analysis brought out two major facts: (1) Statistics on retail furniture sales in major cities and by states indicated that the "star" was selling his 33 per cent of the company's total in cities having 35 per cent of the total potential, and (2) 98 per cent of his sales were in the company's cheaper line on which gross margins were narrower. The company was rapidly acquiring a reputation as a promotional house. The other salesmen were selling considerable amounts of the more expensive line in smaller cities where such sales are much more difficult. The management reapportioned territories, giving the major cities to salesmen covering the respective states in which they were located. After a temporary falling off, sales volumes returned to normal with a large increase in percentage of sales of better grade furniture, increasing the company's gross margin and improving its reputation for quality.

### *Procurement Policies*

Procurement policies, in common with all departmental policies, are guided and limited by general policies formulated by stockholders

and directors. They are merely the more detailed and specific plans made by the procurement department in its endeavor to carry out the broader directives. Choice of industry and determination of product lines will largely determine varieties of materials, equipment, and personnel needed by the procurement department. Selection of competitive level will influence procurement policies as to quality of materials and equipment, processing methods, and inspection requirements. Degree of aggressiveness fixed by stockholders or boards will influence scale of operations and rapidity of expansion.

Many "distribution" policies have strong procurement implications. In some instances, range of sizes, styles, colors, and finishes affect procurement costs more significantly than they do income from sales. Typically, the sales department presses for greater variety, while procurement advises fewer models and longer runs. As noted above, decisions with respect to territories within which distribution will be sought may largely determine the location of branch plants. Size of the customer's order typically does not influence procurement policy where sales are made from stocks of finished goods. Where goods are made to order, the customer's order fixes the size of production run, and policies governing acceptance of orders become fully as important to procurement as to distribution.

Management must decide whether to buy completed products for resale, to buy parts for assembly and sale, or to buy materials and make and assemble parts to obtain a salable product.<sup>2</sup> Such decisions may be made piecemeal, part by part and operation by operation, or reasonably general policies may be formulated covering large classes of parts or operations. Some companies seek to control quality by making all parts. Others seek to keep investment low and relatively mobile by farming out such work as gear cutting and screw machine jobs. One furniture company has persistently provided expansion by buying wood for certain bench and table tops in progressively more finished form: first cut to size, then smooth on all faces and edges, finally glued and sanded ready for staining and polishing.

Another major production policy determines whether the company is to use continuous-process or intermittent-process methods. In the former, products are sharply standardized; special machinery is used, grouped according to the parts worked on and arranged in the sequence of operations; bulk-handling equipment is used, *e.g.*, belt conveyors,

<sup>2</sup> See James W. Culliton, *Make or Buy*, Harvard University Press, Cambridge, Mass., 1942.



pipes, chutes, and rollers; personnel have less technical skill and need less versatility; and routing and scheduling are rudimentary. In intermittent-process manufacturing, standard machinery is used, grouped in batteries of similar machines; batch-handling equipment is used, e.g., trucks, barrels, skids, and cranes; personnel tend to be highly trained and versatile; and routing, scheduling, and dispatching may become highly elaborate.<sup>3</sup> One company makes parts on an intermittent basis, assembles orders for 12 or more steam shovels on a continuous assembly line, and assembles smaller orders on a unit assembly basis. This decision is based strictly on cost considerations but is not recomputed for each order; i.e., a *policy* has been adopted.

Some managements adopt policies directed at stabilizing plant load factors. Sometimes finished goods are produced and stored in anticipation of sales peaks. In other instances, new lines are developed to fill off-peak periods—a matter requiring close cooperation by the sales department. Special sales efforts may be made or price concessions offered to build off-peak business.<sup>4</sup> Selection of one or more or none of these expedients is a matter of managerial choice resting on analysis of costs and incomes associated with each possible policy.

Policies of personnel procurement often rest more on intangibles and less on cost and income analyses than those considered above. The personnel department is often regarded as an auxiliary or service department. Consequently many of its policies are supplementary to sales and production policies. The type of salesman to be selected, the training to be given him, and the general level of his compensation are largely determined by the nature of product lines chosen and of the market sought. Technical products may require engineer salesmen with considerable technical training—indicating relatively high levels of remuneration. Other products require the dogged persistence of the house-to-house peddler. Comparable factors enter the problem of selecting and training factory labor.

Having fixed the goals of personnel policy in job specifications imposed by sales and production policies, there remains a choice of means. Shall candidates be secured by advertising, by school visits, through employment agencies, or among the friends and relatives of present em-

<sup>3</sup> W. N. Mitchell, *Organization and Management of Production*, Chap. 3, McGraw-Hill Book Company, Inc., New York, 1939.

<sup>4</sup> For an extended discussion of the problem and policies to cope with it, see *Business Cycles and Unemployment*, McGraw-Hill Book Company, Inc., New York, 1923, preferably third impression, which contains material not included in the first. Many illustrative examples are given.

ployees? Shall experienced help be sought, or shall green employees be hired and trained? Training may be imparted through special trainee programs, by cooperation with educational institutions, or by training on the job. Finally, shall vacancies at higher levels be filled by promotions from below, or shall competent personnel be sought outside the enterprise?

Selection and placement of employees may be based on their past histories as revealed in application blanks, on impressions gained in interviews which may approach oral examinations, or on a basis of an experimentally developed program of aptitude and ability testing. Costs associated with labor turnover—costs of finding, selecting, and training replacements—can be multiplied by the reduction in replacements produced by a testing program, and the product (savings realized) compared with the costs of administering such a program—cost of supervision, clerical help, space, supplies, etc. Intangibles, such as improved employee morale, will favor reducing turnover if the alternate programs are otherwise approximately equal.<sup>5</sup>

A long list of employee services are subjects of company personnel policies: pension plans, annual wages, group insurance, hospitalization, credit unions, sick leave, cafeteria, and recreational facilities are a few of the more common. Nor have laws and unions taken policies with respect to industrial relations completely out of management's hands. Some managements actively cooperate with unions, whereas others do only as much as they must. Some even share the initiative through powerful labor-management committees.<sup>6</sup>

Procurement policies also govern activities of the purchasing division. Some managements shop for bargains in materials, seeking especially distress merchandise. Others seek a few dependable sources, hoping thereby to ensure receipts of materials in periods of unusual scarcity. Some keep selling and purchasing activities strictly divorced, whereas others practice reciprocity in greater or lesser degree. Many managements persistently debate the degree to which purchasing should anticipate price movements. An outstanding academic exponent of the purchase-to-meet-needs school became general manager of a large enterprise and soon fell victim to a general belief that cotton prices would rise sharply. He reaped poetic justice when a severe price decline caught his enterprise with an extraordinarily large inventory of cotton goods.

<sup>5</sup> Tiffin, *Industrial Psychology*, Prentice-Hall, Inc., New York, 1947.

<sup>6</sup> Golden and Ruttenberg, *Dynamics of Industrial Democracy*, Harper & Brothers, New York, 1942.

### *Planning Policies*

Planning department activities are also governed by policies. Goods may be manufactured for specific customer orders, or coordination between selling and procurement may be sought through the use of stock limits, *i.e.*, the assignment of ordering points and standard lots for each stock item. A third possible coordinating policy, which is growing in popularity, is manufacturing to meet demands forecast by a sales budget. A management may adopt the policy of controlling inventories, purchases, and production of such minor items as screws, rivets, and springs by stock limits, while production of major parts and subassemblies is regulated by budgetary processes.

Policies may vary as to completeness and care with which budgets are prepared by the planning department. All aspects of enterprise operations may be forecast, and the estimates integrated into a single coherent program, or activities of selected departments may be coordinated through budgetary processes covering only the departments selected.<sup>7</sup> Thus sales and manufacturing and purchasing are often coordinated by budgets that do not attempt to bring personnel or accounting activities into the program.

An important policy determines who is to do the planning. Recent tendencies have been toward ever greater inclusiveness in every type of planning. Many budgetary procedures require acceptance of estimates or quotas by employees responsible for performance. In many systems, estimates originate with those responsible for subsequent execution. The advice and suggestions of clerks are sought when clerical procedures are redesigned. Committees are established to formulate shop rules or other policies. The tendency in motion study application has been to teach motion study to the operator instead of requiring slavish adherence to operation instructions devised by specialist planners. This broadening of the planning base improves motivation by enlisting the employee's interest—he feels he must prove his plan good. It also improves the plans by bringing more intellects to bear on each problem, including some that have unique opportunities to acquire detailed factual and experiential background.

### *Control Policies*

The control department seeks meticulous adherence to established plans and rules. However, detailed audit of performance and enforcement of rules are expensive processes. Management again con-

<sup>7</sup> See "Incomplete Budgeting" by Robert M. Vega in *N.A.C.A. Bulletin*, Vol. 15, No. 16, Sec. 1, Apr. 15, 1934.

fronts a wide selection of possible policies and again seeks the optimum compromise. This is clearly seen in an examination of policies governing inspection of raw materials, purchased or manufactured parts, and finished product. One limit to the range of possible policies is 100 per cent inspection after each operation—an extremely expensive proceeding. The other limit is no inspection at all—with consequent loss of customer good will because of defective products and all the expenses associated with claims and adjustments. The optimum compromise is approached by matching costs of additional inspections against losses arising from further processing of goods already ruined. Such calculations may be repeated for the operation sequence of each part,<sup>8</sup> or it may prove possible to establish general rules that will accomplish substantially the same result with less calculation.

Management may insist upon “proof” of the arithmetic accuracy of clerical work by such devices as “tying in” the cost records with the general ledger trial balance through the use of control accounts and subsidiary cost ledgers. Or management may be content with a statistical cost system verified only by a check of recorded performance against established standards followed by investigation of all substantial deviations.

Another type of control policy is revealed by management’s attitude toward enforcement of budgets. Budgets may be used solely as a guide. They may be used to require explanation of substandard performance after unsatisfactory operations are revealed by comparison of actuals with budgetary estimates. Or they may be given the force of appropriations with the control department empowered to halt further expenditures once the budgeted figure has been reached. This forces the responsible manager to seek supplementary appropriations before a partially finished task can be completed.

#### ORGANIZATIONAL CONFIGURATION

Organization is the plan of division of labor. It involves (1) departmentalization to achieve effectiveness in managerial direction of operations and usually to obtain the advantages of specialization, and (2) coordination to bring departmental plans and activities to a sharp focus on enterprise objectives as formulated by the board of directors.

##### *Departmentalization*

Enterprise activities may be analyzed into myriads of elemental acts. Physical activities, for example, may be dissected into “ther-

<sup>8</sup> See footnote on p. 256 of *Management of an Enterprise*, by Balderston, Karabasz, and Brecht, Prentice-Hall, Inc., New York, 1937.

bligs.”<sup>9</sup> *Departmentalization* is the process of combining appropriate elements into *jobs* (a job being taken as full-time occupation for one individual), jobs into sections, sections into divisions, and divisions into departments. The technique of motion analysis may be employed to determine which elemental acts are necessary, the desirable temporal sequence in which such acts should be performed, and the manner of grouping elemental acts into jobs. This is the general procedure used to determine the distribution of work among operators on a continuous-process assembly line.

Considerations of variety, difficulty, and dispersion of work performed on any level of the organizational hierarchy determine the span of control, *i.e.*, the number of persons on this level who are supervised and directed by a common superior. The organization of the supervisory staff is most conveniently roughed out by analysis from the top down. Within the effective span of control of the chief executive, what are the major “natural” divisions of the enterprise? This depends upon the broad policies determining the range and volume of activities. Most manufacturing enterprises require a factory manager, whatever may be the title under which he operates. Highly technical products suggest a need for an elaborate engineering department, headed by a major executive reporting directly to the chief executive. Practically all profit-seeking enterprises require a sales or distribution manager directing a large and complex variety of marketing activities.

Many aspects of the roughed-out organizational configuration must be reviewed to determine details of assignments. Proper placement of certain activities, sections, or divisions may involve considerable study. Objectives and considerations that should guide such study are briefly reviewed below.<sup>10</sup>

#### *Grouping activities to economize personalities*

1. Grouping according to similarity of physical requirements, *e.g.*, use of women for light and of men for heavy assembly work.
2. Grouping according to similarity of knowledge required, *e.g.*, grouping certain activities in an engineering department because ef-

<sup>9</sup> See Ralph M. Barnes, *Motion and Time Study*, 2d ed., John Wiley & Sons, Inc., New York, 1940, especially Chaps. 6 and 10.

<sup>10</sup> The author is indebted to L. C. Sorrell, *Traffic World*, Vol. 46, Nos. 24, 25, and 26; Vol. 47, Nos. 2 and 4, 1930-1931, for this line of approach. The present treatment differs from Sorrell's in many details, chiefly in adding and grouping items.

fective performance requires a knowledge of the same set of facts and principles.

3. Grouping according to similarity of thought processes or temperaments required (see pages 53 to 58).

4. Grouping to take advantage of special combinations that happen to be available.

*Grouping activities to economize time*

1. Grouping sufficient activities to secure a proper full-time load.

2. Grouping to obtain proper load balance, *e.g.*, dovetailing peaks, providing a bank of work to absorb idle time.

3. Grouping according to physical proximity to reduce time lost in travel.

*Grouping activities to train for promotion*

1. Rotating and transferring to give greater variety and so prepare for promotion to positions supervising a wider range of activities.

2. Grouping into broader and more varied combinations than otherwise desirable. One of the advantages of the divisional<sup>11</sup> type of organization is the opportunity to promote from smaller to larger posts of essentially similar character. The functional type of organization often fails to make adequate provision for succession to the chief executive position.

*Grouping activities to secure coordination*

1. Subordinating one group of activities to another to give the more important control of the policies and activities of the less important.

2. Avoiding duplication by merging activities that tend to duplicate, *e.g.*, a growing tendency to merge production control and cost accounting.

3. Avoiding disrupting competition by merging responsibilities. Night foremen may be subordinated to day foremen to avoid undesirable competition, *e.g.*, concealing methods or tools.

4. Creating special coordinating groups of activities, *e.g.*, the planning department (see page 56).

*Grouping activities to provide checks and balances*

1. Fixing responsibility by grouping activities to make possible the setting of relatively independent standards and the measurement of

<sup>11</sup> See p. 79.

achievements and costs, both following the established lines of authority and responsibility.

2. Providing healthy competition between shifts, between branches, or between divisions, *e.g.*, safety contests.

3. Providing independent inspection and audit to prevent fraud and to correct error.

4. Providing for review to check one manager's judgment by another's, *e.g.*, typical appropriation procedures.

#### *Grouping activities for experimentation*

1. Isolating effects of experiment. Separate corporations may be formed to separate the risks of the new venture. Pilot plants may be constructed to avoid disrupting current operations in a going plant.

2. Allowing free development of the new. It was long alleged that "battleship admirals" thought of aviation in terms of its being the "eyes of the fleet" and not in terms of an independent striking force.

#### *Departmental Interrelationships*

The departments may be divisional or functional.<sup>12</sup> A divisional department has a relatively independent job to do and contains all organizational elements necessary to accomplish its objective. The military "task force" is an excellent illustration. A functional department is a specialized part of a divisional department or of an enterprise operating as a single divisional department. Like an organ of the human body, it must perform its function if the organism as a whole is to prosper. Product and territorial departments tend to be divisional; sales, personnel, etc., to be functional. Practically all existing organizations utilize both types of departmentalization, usually on different levels of authority but sometimes on the same level.

Line authority carries a flavor of the divisional type of organization. Divisional units are self-contained, and there is no need for any type of authority acting across organizational boundaries. Functional authority goes with functional departmentalization. Functional units must closely coordinate with one another; often they exist as service units. In either event, occasions will arise in which effective action will require orders crossing organizational boundaries. Such orders carry "functional authority."

Divisional organization tends toward decentralized authority, *e.g.*, a railroad wrecking crew as a "task force." Since a divisional unit con-

<sup>12</sup> This approach was suggested by unpublished material prepared by H. P. Dutton. The present treatment differs in many details.

tains all elements necessary to carry out a task, it can be given much autonomy after its task has been assigned. Functional organization tends to centralize authority in order to achieve necessary coordination between functions and to gain greatest benefit from extensive use of specialists. The gain from specialization must be balanced against the costs of adequate coordination.

### *Coordination*

Activities of various organizational units are directed toward common goals by a variety of devices. Coordination through integration of plans has been discussed (pages 27 to 28, 63 to 66, 68) as has coordination by systematic procedures (pages 16 to 18). The most intimate coordination of activities is achieved by assignment to a single competent individual for execution, *e.g.*, the coordination required of an artist or an athlete. A close approximation may be obtained by subjecting activities performed by several persons to a single personal direction as in a symphony orchestra, a football team, or a combat squad. As the number of persons involved becomes greater, intermediate levels of authority and direction must be interposed between directing head and operational activity. As the number of levels increases, greater reliance must be placed in coordinated plans effectively communicated, in cleverly conceived systems of procedures, and in such devices as committees and special coordinating departments.

Committees are valuable coordinating devices. For example, one company has an office wage committee composed of personnel manager and office manager as permanent members and one other department head appointed on a rotating basis. The committee surveyed the wage structure of the company's office staff and devised job descriptions, requirements, and rate ranges. Its study revealed many inequities among jobs and departments. One department head aggressively pushed subordinates up the wage scale. Another overvalued the dollar and followed a parsimonious wage policy. A third was preoccupied with other problems and was thunderstruck when he learned he had recommended no subordinate for 6 months. The committee corrected these abuses, educated department heads, and coordinated the company's wage policy. It continues to function as a merit award and promotion committee to maintain balance and equity in the company's treatment of office employees.

Similarly a design committee may coordinate certain aspects of sales, production, engineering, and customer service activities. In many plants a production committee schedules operations. Daily or weekly



meetings of foremen are held to review progress of orders through the shop. The roll of unshipped orders is called, and appropriate foremen report job status and prospects. The method is clumsy, expensive, and inefficient, but it does keep material flowing through the plant and so prevents a complete breakdown of production.

The scheduling (often called "planning") department is the archetype of special coordinating departments. It plans the work of factory processing departments. In extreme instances, it assigns each hour of each machine's time to a specific job, thus coordinating the flow of all materials from stock, through processing centers in all departments, and into final assembly operations. In times of labor shortage, it may also seek to assign each hour of each available factory hand to specific operations on designated jobs.

### *Organization as a Compromise*

The various organizational factors discussed above generally conflict with one another. A grouping of activities that best satisfies one criterion may prove untenable for other reasons. A perfect grouping from the point of similarity of knowledge required may require modification to meet needs imposed for similarity of physical requirements. Some economizing of personalities may have to be sacrificed to secure greater economy of time. Independence of action may be partially sacrificed to needs for coordination or for checks and balances.

An illustration of such compromise is the common problem of organizing the stenographic work of an enterprise. Assignment of stenographers and secretaries to individual executives or even to small organizational units tends to waste stenographic time. Typically, an executive's need for stenographic service fluctuates. A stenographer assigned to him will be idle part of the time, overloaded part of the time. When she is overloaded, he will lose time waiting for essential services. The stenographic pool is one solution to such troubles. This conserves stenographic time but may waste executive time waiting for a stenographer to appear and tends to lose advantages that flow from specialization among the stenographers themselves.

Furthermore, an organization is a living, changing, growing organism. It resists capture in a neatly planned organizational configuration. The individual personalities that constitute the organization grow, decay, pass away, and are replaced. An employee earmarked and trained for one promotional sequence develops an interest and a flair for rather distantly related activities. Activities them-

selves likewise grow, change, or shrink. One product line expands, while another contracts. The whole enterprise waxes and wanes with the ebb and flow of the business cycle and with other changes in the economic environment. This constant flux tends to erode everything connected with the enterprise: policies, procedures, performance standards, job descriptions, wage structures, shop methods—all tend toward obsolescence and all need continual maintenance.

A manufacturer of heavy construction equipment had an annual volume of \$3,000,000 in 1940, \$6,000,000 in 1941, \$9,000,000 in 1942, and \$12,000,000 in 1943. New buildings were erected and new machinery acquired. Promotion was rapid, as old employees were upgraded to supervisory positions to train and direct multitudes of new employees. The war decimated ranks of new and old alike. New activities called forth new departments such as priorities and subcontracting; expanded others immensely such as purchasing, personnel, and factory; and collapsed still others such as sales. Highly paid personnel were transferred to fill holes at high levels in inflated departments. Some employees demonstrated great capacity for making adjustments and growing to meet the challenge of new opportunities and were leapfrogged past others of longer experience but less plasticity. The policies, organizational pattern, and procedures could be worked out for any stage of the performance; but long before personnel could be secured and trained for selected positions, further changes and personnel losses required promotion of learners before they had qualified in previous positions.

Much the same type of change occurs at slower tempo in more nearly normal times. There is a continual upward percolation of replacements as men on higher organizational levels drop out. Individuals grow at different rates and rise to different levels before reaching their ultimate growth. An entrepreneur hired a factory manager, a sales manager, and then a controller. The factory manager tired of the strife and failed to keep pace with a growing business. The sales manager maintained his adequacy but failed to broaden. The youngest and last of the three developed an astonishing grasp of organization and became the logical successor to the general manager. But the sales manager balked at following the lead of his junior colleague. As joint owners of a close corporation, none of these top executives could be relieved of his post without creating major difficulties. The sales manager was particularly essential because of his understanding of the company's markets and his personal hold on its customers.

Such conditions make organization something less than perfect and something more than a science. It is an art of compromise, of getting the best out of whatever is available. All products of managerial skill tend to deteriorate, nor can any be patched to reproduce a former desirable condition. New components differ from old, and managerial organizational skill consists in building an ever better organization by recruiting, training, and upgrading ever more effective replacements.

Intangibles so dominate development of an effective organizational configuration that accounting has little assistance to offer management in this field. The converse is untrue. The organizational configuration profoundly influences the classification employed in the accounting records. Managerial accounting is directed toward supplying men throughout the organizational pattern with information they require to plan and control activities assigned to them. Consequently, the whole pattern of accounting reports, as well as the account classification, reflects the organizational setup of the enterprise.

## PROCEDURES

### *Nature of Procedures*

Procedures are a species of managerial planning. As such, they share with policies and organizational configuration the objectives and techniques of managerial planning. Procedures, in common with other forms of planning, seek to avoid the chaos of random activity by directing, coordinating, and articulating the operations of an enterprise. They help direct all enterprise activities toward common goals, they help impose consistency across the organization and through time, and they seek economy by enabling management to avoid the costs of recurrent investigations and to delegate authority to subordinates to make decisions within a frame of policies and procedures devised by management.

Procedures also share the techniques of managerial planning. Many alternate procedures may implement the same policy complex. The managerial technique for devising procedures, as for all other planning, is one of analysis of alternate possibilities and selection of the most desirable. For example, professional firms are jealous of the accuracy of their reports. The final copy must be carefully checked to eliminate errors of typing. Columns of figures may be checked by reading back, figure by figure, to check against the original, or they may be checked by footing and comparing the total with that of the original column. The two procedures can be checked for effectiveness in catching errors and for cost.

Policies are relatively general, reasonably permanent managerial plans. Procedures are less general but comparably permanent. A policy maps out a field of action. It determines objectives and limits the area of action. Procedures are stipulated sequences of definite acts. Procedures mark a path through the area of policy. They may fork, generally with adequate clues to determine clerical choice of path; they may contain trivial gaps to be filled in at the discretion of a clerk; but there is little that resembles the extension of a policy. Procedures are not multidimensional; they do not cover areas of behavior; they have only chronological sequence.

Procedures implement policies. Specific routings of salesmen embody a policy concerning territories within which sales shall be sought. Scheduling of work through the shop gives effect to policies regarding size of inventories and balancing of load factors. As already noted, production planning procedures may, as a matter of policy, be based on estimated shipping requirements, on stock limits, or on customer orders. Similarly, purchasing procedures may implement a policy of shopping the market for bargains or one of selecting a few reliable sources. Policy always sets an objective or delimits an area of action, while procedures fix a path toward the objective or through the area. Sequence is the *sine qua non* of procedure.

### *Structure of Procedures*

Since a great objective can be analyzed into partial objectives or a large area divided into smaller areas, a major policy can be subdivided into a number of minor policies. Thus policy has structure—usually paralleling the organizational configuration. Procedures also have structure. Many important procedures cross departmental lines, binding the activities of all into a common effort. Thus, a typical sales order procedure is initiated by receipt of an order from a customer. The sales department interprets the order and prepares multiple copies on the company's own standard forms. One copy may be sent to the engineering department as instructions covering necessary designs and estimates. Another may later be sent to the factory as an order directing the factory to produce the articles required for shipment to the customer. A third may be sent to the shipping department directing it to make shipment of the goods when received from the factory. A fourth may be sent to the bookkeeping department as an original evidence to be journalized and posted. A fifth may be sent to the customer as an invoice. These procedures

obviously supply an important part of the connective tissue that holds the enterprise together.

Such all-pervasive procedures are main arteries tying together a great many branch paths. Many of these subordinate procedures are intradepartmental in character, but not necessarily so. Thus a complete sequence of cues and acts touched off by receipt of a customer's order could include all details of interpretation and write-up of the order by the sales department, origin and issuance of a series of shop orders with all their supporting documents and posting of production control records by the planning department, origin and return of reports of shop performance with more posting of production control and cost records, and all billing and collection procedures in the accounting department. Automatically instigated ramifications may lead through virtually all purchasing and disbursing procedures, into all pay-roll procedures, etc.

There are also a large number of relatively independent procedures tending to be largely intradepartmental in nature. Among these are procedures governing assignment and payment of second or swing shifts, employee bidding on job vacancies, the settling of employee grievances, seniority rights, handling of customer complaints, taking physical inventory counts, and many more. Though adding little to the coordinative machinery of the enterprise, these procedures are of great importance in achieving the objectives of consistency and economy.

All these procedures are implemented by a great mass of detailed procedures pertaining to single operations—often called “standard-practice instructions.” For example, the operation sheet charts a series of acts by a number of employees necessary to production of articles ordered by a customer or needed for stock. Each operation listed is defined and described by blueprints and standard-practice instructions detailing setup, tooling, fixtures, feeds and speeds, and motion patterns. Standard-practice instructions govern such activities as issuance of new telephone directories, the routes of plant messengers, follow-up of delayed purchase orders, the posting of journal entries to the ledgers. Some companies produce “manuals of style” to govern preparation of letters, reports, and other written documents used by the company.<sup>13</sup>

<sup>13</sup> For example, among a multiplicity of other procedures governing its educational processes, *e.g.*, matriculation, registration, the University of Chicago issues a 61-page booklet of detailed rules governing the physical appearance of dissertations submitted by candidates for higher degrees. A typical detail is the insistence on the use of Roman numerals to designate chapters.

Similar manuals may regulate various accounting or tabulating procedures.

### *Recurrent Procedural Problems*

A number of problems recur persistently in the course of procedural design. Among the most common are (1) relevance of the procedure, (2) duplication of effort, and (3) use of clerical substitutes.

*Relevance of procedure.* Perhaps most frequent and most important of recurrent procedural problems is the problem of relevance. Does the procedure do a useful job? Is it worth what it costs? There are several major sources of useless procedures. Clerks and minor supervisors may attempt to build up their prestige and bolster their security by devising intricate and obscure rituals. Or procedures may become obsolete without being discontinued. For example, material shortages may plague a company. Reports may be instituted to inform a number of executives as to condition of inventories and probable delivery dates on outstanding purchase orders. Later the supply situation eases. One by one the executives no longer need or use the report. None orders it discontinued, as each believes that others use it. But the law of clerical procedures inexorably produces and submits the report until positive orders are issued to discontinue it.

Many procedures are traditional or copied from other enterprises where they may or may not be useful. Perhaps many cost procedures illustrate this possibility. Some costs are computed because "all businesses should figure costs," not because someone is going to use the figures obtained. It is customary for cost accounts to "tie in" with general ledger controls, but many cost systems have gradually been converted to standard cost systems in which clerical errors and deviations of performance from standard are merged in the variance accounts. Yet extra clerical costs are incurred to figure costs on trivial nonrepetitive jobs or to obtain redundant data on repetitive work to secure the tie-in that no longer serves its prime purpose of proving arithmetic accuracy.

Procedures may lose relevancy by getting hopelessly behind. Data produced may be altogether obsolete, and yet reports continue. For example, one cost department was reporting costs of producing tools some 9 months after tools were completed and in use. By the time facts regarding excessive costs of tool production became known, it was much too late for the superintendent to take remedial action. Finally, the superintendent issued instructions to skip 9 months of figuring tool costs and so got on a current and useful basis. Had he

worshipped the tie-in with general ledger controls, he would have put on extra clerical help to produce useless cost data at an accelerated rate until the data were brought to a current basis.

*Duplication of effort.* Many procedures are needlessly duplicated because of a desire for secrecy or through ignorance. Foremen often keep private records of departmental production because they have no access to or knowledge of duplicate records kept by the planning department. The cost department may keep records of material prices charged by different vendors that duplicate records kept by the purchasing department. Stock-room records, cost records, and planning department records may maintain a useless triple watch over inventory balances. Avoidance of such duplication is one major reason for centralizing responsibility for design of forms and procedures and for conducting periodic reviews of procedural configurations.

Duplication often stems from a desire for "protection." Private, duplicate records are maintained to protect individuals rather than through mere ignorance of existing similar records. Forms may be routed to a long succession of persons or duplicate copies sent each for the legitimate purpose of informing each of certain activities or to provide each with expensive but useless protection. The game may be played to the extent of requiring virtually every person touching a form to initial it to prove he has seen it. He may be required to date his initials to protect himself from a charge of delaying vital procedures.

Skillful design of procedures may eliminate clerical copy work by provision of duplicate forms. For example, copies of sales invoices filed chronologically may serve as the sales journal, eliminating traditional methods of journalizing. In some instances, another copy filed alphabetically may serve as customer's ledger, substituting filing for more expensive forms of posting. Such multiple use has resulted in many companies producing tens or even hundreds of copies of basic documents. So many companies are requesting duplicate or triplicate copies of invoices that provision of such copies is becoming standard practice. Some procurement divisions of the Federal government require as many as 21 copies of invoices. The principle involved is sound. Why should clerks in one company copy documents prepared by clerks in another if the first can produce the required number of forms with little or no extra effort?

Sometimes accuracy is sought through verification by duplication. Thus, extensions may be computed on the customer's order and re-computed on the sales invoice to prove the accuracy of the original

computation and of the subsequent typing. When possible, it is usually cheaper and better to verify by juncture rather than by duplication. An illustration is the checking of total hours reported on job time tickets against the total shown on employees' gate cards. Another illustration is verification of detail carried in subsidiary ledgers by comparison of trial balances of such ledgers with the balances of corresponding general ledger controls.

*Use of clerical substitutes.* Taylor and his disciples revolted against the rule of tradition. Trade mysteries, long carried in the memories of skilled craftsmen, were subjected to scientific test, standardized, and made a matter of record. Policies and procedures were reviewed and reduced to writing. Routing and scheduling were taken from foremen and made subjects of elaborate clerical rituals. Taylor's functional foremen became whole departments: planning, personnel, cost, tool-room, maintenance, stock room, and materials handling. The ratio of indirect to direct labor rose spectacularly.

In general, the new technique proved amazingly effective. Clerical work became important and hence the subject of inventive activity and intensive development. Clerical aids of all kinds were vastly improved. Duplicating devices, calculating machines, visible records, and tabulating equipment were invented or improved to conserve clerical time and reduce clerical errors. Today, determination of the extent to which clerical procedures should be mechanized and selection of the most effective types of equipment are major problems of the procedural analyst.

At times, paper work has been overelaborated. Too many managers at all levels have attempted to use reports to the exclusion of direct observation. For example, a shop superintendent attempted to install planning procedures that would virtually be automatic. Provision was made for reporting all irregularities. There appeared to be no remaining reasons why the man should ever leave his comfortable office. Two disadvantages gradually emerged. The superintendent lost all feeling for intangibles, which resulted in foolish decisions and the antagonism of all foremen, and several clerks were required to keep all records posted currently and to originate the multitude of required reports. A successor superintendent found that one planning clerk armed with a simple memorandum record of shop orders could visit every machine in the shop and ascertain progress of every order in less than 2 hours. The simple memorandum served adequately both as progress record and as report to the superintendent.



Dependence on paper work and the accounting fetish of a tie-in with general ledger controls often produce needlessly elaborate inventory records. There is seldom sufficient reason for carrying extensions and dollar values in such records. Receipts and withdrawals can be entered in physical units, and balances priced and extended whenever financial statements are to be prepared. Furthermore, trivial items can be controlled by physical means rather than by paper procedures. Stock limits can be set, and minimum quantities separately packaged. Each minimum package is thrown into the corresponding bin of parts. When the bin is emptied, the minimum package is broken, and an attached tag bearing the part number is sent to the purchasing or planning department as an indication that a new order should be released for the part.

### DESIGNS, RESOURCES, AND METHODS

#### *Nature and Need of Specific Choices*

Policies, organizational configuration, and procedures are relatively permanent plans of action. They must be supplemented daily by scores of detailed decisions, most of which are virtually automatic applications of general plans to specific situations. Sometimes, general plans allow some latitude within which the specific decision must be made, and some problems arise that were not anticipated and consequently not covered by general plans. As outlined in Chapter 2, specific decisions must be made with regard to such things as product design, choice of processes, and selection of productive resources.<sup>14</sup>

Many technical details of product design are settled as problems of specific choice among alternatives all of which equally meet the requirements of policy and of markets. Such choices are resolved in terms of comparative costs (engineering economy studies), although intangibles may play an important role. A certain pin in a toaster has a groove around its middle, cut to facilitate holding the pin during an assembly operation. The decision to cut the groove followed a simple comparison of the extra costs to cut the groove with the savings possible in assembly. Since the groove was cut as part of an automatic screw machining operation, it involved either a slightly more expensive

<sup>14</sup> E. L. Grant, *Principles of Engineering Economy*, and the parallel problem book contain many excellent examples of such problems of managerial choice. In addition to Grant, see Mitchell, *op. cit.*, Chap. 9. Further interesting problems of managerial choice appear in Vatter's final chapter in Neuner's *Cost Accounting*, Business Publications, Inc., Chicago, 1938.

tool or an extra operation in the screw machine cycle—neither very expensive. No marketing factors and no policies were involved.

The literature of management and of engineering economy are full of problems of selection of processes and equipment. Frequently recurring is the choice between turret and engine lathe or that between conveyor and wheelbarrow. Such problems are often simplified by assuming equal floor space and power requirements or otherwise eliminating difficult items. Where not assumed equal for all alternatives, the typical illustration either introduces assumptions that reduce such items to a “sunk” status or follows the oversimplified, unrealistic allocations of traditional cost accounting.

Another omnipresent specific problem of choice is the decision to buy or to make, applied part by part and operation by operation. Many companies relieve overloaded production centers by farming out items scheduled for congested centers. This involves choice among items as to which go out and which are done in the company's own shop. Some companies avoid investment in certain machines by buying materials partially processed, *e.g.*, rough-cut gears. Many companies find it cheaper to have plating or anodizing done outside. In most metalworking plants there is a continuing, day-after-day determination of which tools, dies, jigs, and fixtures will be made in their own toolrooms and which will be purchased. In all these situations, the solution frequently follows traditional cost accounting patterns in their fallacious handling of fixed and sunk items and practically invariably follows the simplified allocation patterns of cost accounting with no adjustments for quantity discounts, overtime premiums, and the vast variety of behavior patterns of overhead items.

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## CHAPTER 5

### PHYSICAL STANDARDS: THE BUILDING BLOCKS OF MANAGERIAL PLANNING AND CONTROL

Purposes of chapter: to begin the analysis of techniques of managerial planning and control, to exhibit the fundamental role of physical standards, to describe how operating standards are established and maintained, and to provide a basis of elemental operational units needed in later chapters.

Chapter 2 outlined the objectives of managerial accounting, and Chapter 3 sketched the environment in which management and managerial accounting must operate. Chapter 4 indicated in greater detail the range and nature of planning problems of management.

Chapter 5 temporarily abandons the analysis of managerial problems and their settings. It begins the development of the techniques used by management to solve such problems. The present chapter analyzes physical standards—the most independent, basic, and elemental data used by management. Virtually the entire structure of managerial planning and control rests upon calculations embodying permutations and combinations of these elemental physical standards.

Subsequent chapters will investigate the translation of details of physical plans into their pecuniary implications; the gathering of such data into over-all, integrated pictures of status and progress of the enterprise; and the utilization of such calculations in the processes of managerial planning and control.

#### THE ROLE OF PHYSICAL STANDARDS

##### *Nature of Physical Standards*

Managerial plans are constructed of elements that are largely interchangeable as among plans. These elements are physical standards: hours of operating time per piece for each operation performed, feet of bar stock per piece for each part made, pounds of coal per pound of steam—thousands upon thousands of detailed physical standards. Such standards may be qualitative as well as quantitative. Tolerances as well as dimensions are specified. Grade and type of labor required

for each operation are determined as well as setup and operating hours. Chemical compositions are prescribed as well as pounds or tons of materials.

The most basic of these standards tend to be established by counting or measuring or experimentation. In market analysis, the number of prospective customers in each geographic division can be established by counting, *e.g.*, the number of laundries in each county. Hardness and tensile strength of raw materials can be determined by laboratory measurements. Effectiveness of advertising copy can be tested in a few typical towns. Operation times, or therblig times, can be measured by stop watch or motion-picture camera.

Many other physical standards are derived from these by calculation. Dimensions of structural members are calculated from load data and such physical constants as moduli of elasticity and yield points. Other dimensions are established on the drawing board, fixed by the required relationships among parts. Synthetic operation time standards are constructed from elemental times. Pounds of plastic powder needed per unit of product are calculated from known dimensions and densities.

### *Building Blocks of Managerial Planning*

As was indicated in Chapter 2 and in greater detail in the last chapter, managerial planning consists largely in exploring alternate programs of future action with a view to selecting the most attractive. Whether management must choose between alternate policies, organizational configurations, procedures, or resources, it must always analyze the rival programs in terms of their physical elements, determine the financial implications of these elements, integrate or synthesize the elements into programs, and select the best program it can devise. Many of the physical elements are constants that enter into any or all plans much as toy building blocks enter juvenile construction projects.

Chapter 4 explored the range and nature of managerial problems of planning. One such problem was the determination of the market to be sought. More specifically, a management may be concerned with a choice between local and national distribution of its products. Market research provides data with respect to number, type, and location of prospective customers. Hypotheses are framed and experimentally tested as to desirable sales appeals and as to frequency and types of contacts necessary to develop various proportions of market potentials. Alternate hypotheses are reduced to specific programs by

calculations based on relatively constant physical standards. Advertising contacts are planned on the basis of published data concerning sizes and types of circulations of various media. Salesman contacts are planned in terms of maps and timetables and of standards covering number of calls per day per salesman and the ascertained frequency of calls necessary to sell satisfactory percentages of various types of customer.

These sales activities are expected to result in definitely predicted sales volumes. Through further physical standards, these sales volumes can be converted into hours of setups and of operation of specific machines and types of labor. Pounds or square feet or gallons of materials needed can be calculated from known dimensions, densities, or other physical standards. Floor space, heat, power, and other requirements can be calculated by applying other standards to the calculated machine hours. Virtually entire programs can be built out of experimentally determined or calculated physical standards.

The rival physical programs are priced out and compared, and the most attractive adopted. These techniques are elaborated in the next four chapters.

### *Building Blocks of Managerial Control*

The selected program is torn apart, and its elements, these same physical standards now under discussion, regrouped according to individuals responsible for executing each facet of the plan. Thus, these standards are grouped into patterns following the design of the organizational hierarchy. Subsequent performances are measured, recorded, and compared with the standards. This necessitates measuring and recording performances arranged according to the same pattern of responsibilities, subdivided into items paralleling the established standards. Finally, substandard performances are investigated and remedial action instituted. The techniques of measuring, recording, comparing, investigating, and correcting are elaborated in subsequent chapters, especially Chapters 10 and 11.

Typically, individuals are held responsible for three aspects of performance: (1) What did each accomplish? (2) What did each accomplishment cost? (3) How much investment was needed? These major groups of standards are further divided in a general way between standards of quality and standards of quantity. The remainder of this chapter discusses these physical standards with particular reference to their origins.

## STANDARDS OF ACHIEVEMENT

Few basic physical standards originate in the accounting or cost departments. Given an organization similar to that sketched in Chapter 3, most will originate in the research department. If the research function is decentralized, the basic physical standards will be established by engineering, by methods, by sales, or by personnel. Often several departments cooperate in setting such standards, as when the methods department approves an engineering design from the point of view of economy in production and the sales department from the point of view of salability. Wherever and however the standards originate, they are accepted by cost and control departments and incorporated in the records. These records may play a role in policing, checking, and maintaining the basic physical standards.

Each department, each division, each section, and each individual in the organization have work to do, tasks to perform. A well-developed system of physical standards helps inform each as to the amount and quality of work it is required to perform. A survey follows of the physical standards used by management to help plan, direct, and control the work of each of the organizational units outlined in Chapter 3.

*Standards Governing Research Accomplishments*

The market research division may make market studies to determine number and location of prospective customers, market preferences as to product design, comparative effectiveness of advertising appeals and media, or prospective sales volumes and selling expenses. In making such forecasts or in gathering data for managerial use in formulation of sales policy, various tasks are imposed on the market research division. Such work can be subdivided, assigned to specific individuals, and scheduled, and subsequent performance or accomplishment checked against these standards both as to quality and as to quantity.

For example, a field investigation may be worked out along the following lines. One employee is assigned the task of designing a questionnaire to guide interviewers. Various standards as to what constitutes an acceptable questionnaire may be established,<sup>1</sup> and a date for completion set. Quality of the finished questionnaire is somewhat intangible and will have to be judged by a competent supervisor. The

<sup>1</sup> For example, see L. O. Brown, *Market Research and Analysis*, The Ronald Press Company, New York, 1937, especially Chap. 9.

date on which the task is completed can be checked by any clerk (assigned to the task!) and recorded. Another employee may be charged with the task of determining the composition of the sample to be interviewed—again a task governed by quality standards and quantity schedules. Interviewers will be assigned territories or prospects and given full instructions. Their reports will be scrutinized to maintain quality and counted to determine amounts of work performed by each interviewer. Similarly, work of statistical tabulation and computation may be assigned and scheduled. Later, individual performances can be checked for accuracy and quantity.

Records of such standards, schedules, and subsequent performance form a basis for subsequent planning of similar work. Confronted with such a research problem, a manager must plan to complete the work by the desired date. This involves assigning the proper number of appropriately trained people to each phase of the work. The whole matter follows the regular patterns of managerial planning: various alternate procedures are considered, and the most attractive chosen. The selected plan must then be reformulated in terms of individual responsibilities to secure control of operations contemplated by the plan.

The research department is also responsible for technical research directed toward product and process improvement. This work can also be subdivided, assigned, and scheduled. Product engineering may be divided among groups working on different product lines. A designer may sketch a new product. The sketch is turned over to a layout man who determines general relationships of component parts and fixes key dimensions, which ensure that parts work together properly. Each part is assigned to a detailer who works out the precise shapes and dimensions of the part. Part drawings are given to tool engineering. Tool designers work out fixtures, tools, and gauges needed for production. Every step is scheduled. The work load is divided among individuals according to size and complexity of drawings required and according to the role each individual is competent to play.

Broader criteria are available. Product improvement may be measured in terms of reduction of customer complaints or in terms of number of improvements considered of sufficient value by management to warrant the expense of taking out patents, or product and process improvements may be judged in terms of cost reduction; *e.g.*, a deeper section may give required rigidity with less material, a simpler design may reduce spoilage, or a new tool may reduce labor cost.



The economic research division may forecast prices of raw materials, volumes of customer industries, or values of fixed investments. Desired items can be listed, and the work of forecasting scheduled. Quality can be subsequently checked by comparing forecast with event.<sup>2</sup> To the extent that such work requires statistical manipulation of masses of data, the clerical work involved can be subdivided, assigned to individuals, and scheduled. Credit research can be planned and subsequently measured in terms of number of prospective customers investigated and subsequent collection experience.

Much important research is a groping after unknown and often unforeseen benefits. With respect to these phases of research, managerial judgment will obtain less guidance from physical standards compared with records of subsequent performances.

### *Standards of Distribution Achievement*

Distribution achievements are often controlled in even greater detail. For example, contacting prospective customers is planned and controlled in terms of physical standards. Lists of prospects are developed and maintained. Some lists are purchased, others come from trade directories, and still others from inquiries or from salesmen's reports. Such lists are analyzed according to types of products and potential volumes of each likely to be desired by each prospect. One sublist may receive a monthly house organ plus various bulletins and letters plus periodic calls by salesmen. Another list may receive only letters. The net result is a program of contact making, each phase of which is assigned to a definite individual.

Beyond mere number of contacts, promotional achievement may be planned and measured in terms of percentage of inquiries received, of leads uncovered, or of orders secured. Salesmen may be required to make a given number of calls per day and to submit reports on every call. Performance or nonperformance of such tasks modifies managerial judgments based on sales volumes alone. Salesmen are also judged in terms of distribution of orders among the firm's product lines, prices and margins obtained, nature of territory, *e.g.*, pioneering vs. an established clientele, and many other factors.

Sales estimates for planning and control purposes should probably agree in total. Either may be developed and later reclassified for other purposes, or the two sets of estimates may be independently

<sup>2</sup> For example, see G. V. Cox, *An Appraisal of American Business Forecasts*, University of Chicago Press, Chicago, 1930. Also see Wilson Wright, *Forecasting for Profit*, John Wiley & Sons, Inc., New York, 1947.

developed and checked against each other. The patterns of sales estimates for planning purposes are derived from the patterns of alternate programs contemplated; *e.g.*, if a question of range of products is being considered, estimates must be in terms of the lines and items under consideration. The patterns of sales estimates for control purposes parallel the patterns of organizational structure; if assistant sales managers are in charge of territories, estimates must follow the territorial divisions. The patterns for planning and for control may coincide in some respects but rarely in all.

Sales estimates usually depend upon market studies, checked against past experience of the enterprise.<sup>3</sup> An analysis of the sales outlook for a manufacturer of gas hot-water heaters ran in terms of (1) trends in number of dwelling units having gas connections, (2) relative proportions of large, multifamily units not likely to use relatively small gas water-heating units, (3) previous sales of the industry indicating degree of saturation of the market and probable replacement demand (also requiring estimates of average length of life, based on service department records), and (4) competitive position of the company in the industry: comparative design, quality, and price of products, reputation for deliveries, service, fair dealing, etc.

Sometimes demand is derived and analysis takes the form of studies of customer industries. Sales of a steel producer were estimated by analyzing the leading customer industries: automobiles, construction, machine tools, railroads, pipe lines, shipbuilding, and tin plate. These analyses ran in terms of past trends in sales volumes, general economic conditions, technological trends, and governmental appropriations. Having estimated volumes for the entire steel industry, estimated volumes for the subject enterprise were derived by study of compara-

<sup>3</sup> There are a number of books on market research of which L. O. Brown, *Market Research and Analysis*, The Ronald Press Company, New York, 1937, is one of the best. Books on budgetary control usually have one or more chapters devoted to the making of sales estimates; see J. O. McKinsey, *Budgetary Control*, Chaps. 5 and 6, The Ronald Press Company, New York, 1922; P. Sinclair, *Budgeting*, Chap. 7, The Ronald Press Company, New York, 1934; J. R. Bartizal, *Budget Principles and Procedures*, Chap 3, Prentice-Hall, Inc., New York, 1940. There are also chapters on field and statistical investigations of markets and on sales forecasting and quota setting in the marketing literature; see H. W. Hepner, *Effective Advertising*, McGraw-Hill Book Company, Inc., New York, 1941; P. D. Converse, *Elements of Marketing*, Chap. 31, Prentice-Hall, Inc., New York, 1935; B. R. Canfield, *Sales Administration*, Chaps. 19 and 20, Prentice-Hall, Inc., New York, 1941; Agnew, Jenkins, and Drury, *Outlines of Marketing*, Chaps. 12 and 15, McGraw-Hill Book Company, Inc., New York, 1942.

tive locations, types of equipment and trends in kinds of products desired, reputations and aggressiveness of the managements of the major companies in the industry.

Similar techniques can be used in estimating volumes to be secured from each territory or each product. Or a total estimated by these methods can be prorated according to a known distribution of correlated phenomena. For example, a firebrick manufacturer allocates sales quotas to salesmen according to horsepower of prime movers installed in each agent's territory. A manufacturer of occasional tables compares salesmen on a basis of the ratio of their sales to sales of furniture stores plus sales of furniture departments of department stores for the corresponding areas. A manufacturer of piano benches measures the effectiveness of salesmen by comparing their sales with sales of pianos in corresponding states.

Work loads of the delivery division of the sales department are similarly divided, assigned, and scheduled. Achievements are planned and judged in terms of number of deliveries made, promptness, number of errors, breakage, and, in some instances, collections. Typically, the delivery division must meet work loads imposed by sales accomplishments, even though these deviate rather widely from estimated or planned accomplishment. Even so, delivery accomplishments must be estimated as a basis for providing adequate delivery facilities, and actual work loads should be measured as a basis for judging the reasonableness of expenses incurred by the division.

The distribution department also handles customers' complaints. Here again, number is one paramount criterion: how many complaints are handled each week? Quality of this work is measured by the proportion of mutually satisfactory dispositions of claims achieved by the division.

### *Standards of Procurement Achievements*

Purchasing and manufacturing divisions are alike subject to criteria of quality, volume, and conformity to schedules. Quality control involves an almost unbelievable number of standards. Consider dimensions alone. A power shovel or an adding machine contains approximately a thousand parts. Every hole in each part has depth, diameter, angle of axis with respect to each of two surfaces, and distance of center from each of two edges. If the hole is tapped, further dimensional standards fix size, shape, and pitch of threads. Every flat surface requires three dimensions to locate a single point, two angles to

give the position of the surface, and various dimensions to prescribe its perimeter. Curved surfaces are more involved. Finally, all dimensional standards are double: an upper and a lower limit within which the dimension must fall or the part be rejected. All these dimensions are usually given on drawings but must be further implemented with fixtures, tools, gauges, and directions with respect to machine settings. To these dimensions must be added specifications as to composition, again fortified by tolerances to accompany each standard. There yet remain standards of finish and of performance: colors, smoothness, grain, hardness, toughness, and strength. Usually all these standards are established in the engineering department, the processing and purchasing departments are responsible for conforming to the standards, and the inspection department enforces the standards by testing the products and rejecting those which fail to conform.<sup>4</sup>

On the quantity side, standards should establish the responsibility of each employee for getting out the product. A work program is prepared showing quantities of each finished item to be completed in each operating period. To prepare such a program, the sales budget is "exploded" by the planning department to find the implied requirements in terms of assemblies, parts, and raw materials, and these are adjusted to provide for service parts and for contemplated changes in inventories. This results in a program showing the over-all responsibility of the procurement department.

Using time standards derived from past experience, stop-watch studies, or data provided by machinery builders, the planning department analyzes this program into operations and operating times. These data are classified by departments to find departmental loads and by processing centers to find machine loads. The planning department also determines the sequence of operations and the rate at which materials move from process to process. The over-all program for the entire plant may be projected by quarters or months or weeks for a year or more. Departmental loads may be projected for several months, and machine loads for some weeks. Detailed scheduling of job sequences over machines look but a week or two ahead of current operations. These schedules for processing in departments and by

<sup>4</sup> A great many books are devoted to such standards, *e.g.*, *Machinists Handbook*. Many manufacturers' catalogues are handbooks of standards, *e.g.*, General Electric, Carnegie-Illinois, etc. Many societies publish volumes of standards, *e.g.*, American Society for Testing Materials, Society of Automotive Engineers, etc. Various governmental bodies publish a great many standards, *e.g.*, Bureau of Standards, Bureau of Mines, Army, Navy, etc.

work centers form the standards of achievement for foremen and operatives.

In one small company, the sales department prepares an estimate of shipping requirements for each product. This is exploded to determine part requirements, and these are adjusted for service needs and desired inventory changes. Assembly operations are planned in accordance with estimated shipping schedules. Machining operations are planned in accordance with assembly requirements, inventories on hand, and economic lot sizes. Orders are released to the factory to implement these plans. An order register is maintained: orders being entered in sequence and columns arranged to show the date each order was released and is scheduled to enter processing, to clear the machine shop, and to be ready for shipment. Every day the planning manager inspects each order visually to see if satisfactory progress is being made. In each department a rack is maintained with a pigeonhole for each work place. The planning manager arranges blueprints and job instructions in each pigeonhole in the sequence in which jobs are to be processed at the corresponding work place. The job register and the sequences indicated in the racks provide standards of quantitative achievement for each worker and each foreman.

A much larger company schedules jobs to departments in a central planning department. Scheduling to machines is done in departmental offices. A Gantt chart showing jobs assigned to each department is maintained in the planning department. This chart projects departmental work loads 18 months in advance of current operations, showing sequence of jobs and time allotted each in each department. Each processing department maintains a Taylor scheduling board with pigeonholes for "work running," "next job," and "work ahead" for each production center. Weekly foremen's meetings discuss the status of the program and approve details for the ensuing two weeks.

In general, works managers are held responsible for meeting shipping schedules.<sup>5</sup> They (through the operations of a planning department) assign work to departments, delegate authority to department heads, and hold them responsible for achieving the detailed departmental output schedules established. The foremen (through departmental clerks or via the services of the planning department) assign work to production centers and hold individual operators responsible for accomplishing their jobs in conformity to the established schedules.

<sup>5</sup> In periods of abnormal demand the relationship may be reversed; plant capacities may fix shipping schedules, and the sales department will make delivery promises accordingly.

Achievements of service divisions of the procurement department are often difficult to measure. Consequently, standards of service achievement are sometimes stated in vague, qualitative terms, *e.g.*, recruit and maintain a satisfactory work force; maintain adequate records and prepare timely, informative reports; keep buildings and machinery in good operating order. More effective planning and control are achieved where standards of performance are set in measurable terms; *e.g.*, kilowatt-hours produced; pounds of steam (at given temperatures and pressures) supplied to processing departments; number of employees, meeting objective tests of abilities, hired or trained;<sup>6</sup> square yards of floor space swept or of windows washed.

The plant division is charged with repair and maintenance of all equipment and provision of such services as power, light, heat, processing steam, compressed air, hot and cold water, ventilation, and air conditioning. Standards cover cleanliness of floors, windows, walls, and washrooms; temperatures, pressures, and amounts of water, steam, and air; lighting intensities, qualities, and colors; etc. Many such standards are tied to definite schedules to minimize vagueness and judgment elements. Instead of windows being washed or walls painted when dirty, these activities are scheduled; rain or shine, windows are washed once a month, dirty or not; painters circulate through the plant, reaching each point once each year. Lubricating is placed on a schedule basis: oil is changed in the crankcase every 1,000 miles, the front wheel bearings are repacked every 10,000 miles, transmission and differential oil is changed every fall and spring. Minor replacements may be scheduled: lamps, belts, small tools, spark plugs. An average period is determined from past experience, and a schedule established that renders further inspection and judgment unnecessary. Broader criteria are sometimes employed, *e.g.*, hours of down time due to failures of plant or equipment.

The personnel division has a comparable number of standards of achievement. Every job in the enterprise should be described, analyzed, classified, and evaluated. Though relatively permanent, such evaluations have a tendency toward obsolescence, which must be offset by periodic review. The setting and maintenance of such standards are personnel activities, which are themselves subject to planning and control in terms of standards of quality and quantity. Subsequently, the job descriptions and evaluations become quality standards governing employment and training activities of the personnel division.

<sup>6</sup> In 1942 the Buick engine plant at Bellwood announced an intention of hiring 1,000 men per month for 16 months.

Quantity standards governing employment and training activities are established by requisitions submitted by various departments in need of additional personnel. Employees must be placed, transferred, promoted, and rated. Schedules establish regular periodic reviews of the progress of each employee. Other standards govern absenteeism and disciplinary activities. And there are hosts of standards governing safety, working conditions, employee services, cafeteria operation, etc. The personnel division has the double duty of establishing and enforcing most of these standards. The work of establishing and enforcing such standards is itself subject to somewhat vague standards and judgments of quality and standards and schedules regulating quantity.

### *Standards of Planning Achievement*

Almost universally, the primary task of planning departments is scheduling manufacturing operations. The excellence with which the planning department accomplishes this task can be judged in terms of (1) number of idle labor or machine hours scheduled and percentage of such idle time to total available hours; (2) size of raw-material, in-process, and finished goods inventories relative to shipments; and (3) number and duration of shutdowns for lack of materials, tools, fixtures, gauges, or labor. The magnitude of the scheduling job can be measured in terms of number of shop orders or operations scheduled; number of entries posted to a schedule board; number of tabulator cards punched, sorted, and tabulated; etc. If actual operations fail to conform to schedule, management should investigate to determine whether the manufacturing department is short in achievement or the planning department has scheduled poorly.

To illustrate, an adding-machine factory had increased its inventories by \$100,000 during a year in which production declined from 60 to 50 adding machines per day. Meantime, shutdowns for lack of raw materials, purchased parts, and manufactured items had been increasing. Inventory figures were not promptly available, and the year-end physical inventory disclosed many errors in the perpetual inventory records. It became painfully obvious that the planning department was deficient both qualitatively and quantitatively.

The organizational pattern outlined in Chapter 3 also assigned formulation of budgets to the planning department. Criteria of achievement with respect to this task include (1) satisfactoriness of the budget evolved, (2) accuracy with which it predicts subsequent performance, and (3) adherence to the schedule controlling the suc-

cessive steps in the process of formulating the budget. The satisfactoriness of the budget is judged by comparing it with past records and with the rejected alternate plans. The accuracy is measured exactly by comparison with subsequent performance records. Every step of the budget procedure should be scheduled, from the making of preliminary sales estimates to adoption of the completed budget including estimated financial statements. By recording dates at which each step was actually completed adjacent to corresponding scheduled dates, a precise measure of planning department achievement in this respect is obtained.

Accomplishment of the planning department in designing procedures includes quantitative matters of number and complexity and qualitative matters of adequacy, accuracy, speed, and economy. Procedures vary enormously in length and complexity, *e.g.*, a procedure for issuing telephone books as compared with a procedure for ascertaining costs or for establishing budgets. Here again, adherence to predetermined schedules is the most practicable approach to establishing and enforcing standards of quantity of work accomplished. Quality can be judged by comparison with former procedures as to adequacy, accuracy, speed, and economy. Often it is possible to measure fairly accurately the number of clerical hours saved by installation of a new procedure.

### *Standards of Control Achievements*

The inspection function, assigned to the control department in Chapter 3, often lends itself to close control both quantitatively and qualitatively. In screw machine departments, small samples are checked from time to time by a floor inspector whose approval must be obtained before a machine is started up after each shutdown.<sup>7</sup> Such pieces may later be inspected at the bench, by either sample or 100 per cent checking, controlling the quality of work of operator, setup man, and floor inspector. Bench inspection in large-scale plants may be repetitive to a degree warranting motion and time studies followed by establishment of output standards and production incentives. This is especially true of inspection of large runs of interchangeable parts conducted by use of go, no-go gauges.

Planning and control departments both perform much routine clerical work. Much of this can be brought under definite quantita-

<sup>7</sup> For statistical methods of quality control, see E. L. Grant, *Statistical Quality Control*, McGraw-Hill Book Company, Inc., New York, 1946. See Grant's bibliography for other sources.



tive control. Each clerk is assigned a definite stint: so many documents to process, papers to file, tabulator cards to punch, entries to post, letters or documents to type, etc. In many companies, the accomplishment of each clerk or group of clerks is regularly counted (weighed, stacked and measured, or prenumbered) and recorded. Often counts at one stage will suffice for long sequences of successive processes, *e.g.*, the handling of time tickets by a succession of clerks in the pay-roll, planning, and cost departments. In most of this work, quality is synonymous with accuracy and is measured by the ratio of errors to total work accomplished. Often, neatness becomes a secondary criterion of clerical quality, *e.g.*, legibility of handwriting, uniformity of stroke in typing, general appearance, and arrangement of letters and reports.

### STANDARDS OF REAL COST

Each achievement has its costs. Standards of achievement, following the organizational pattern of the enterprise, should be paralleled by standards of physical and pecuniary cost. This is the regular pattern of managerial control. However, the analysis of standards does not necessarily follow this same pattern. In this chapter, we are interested in the varieties and sources of standards. Standards of achievement vary markedly in a qualitative sense from one organizational subdivision to another. Consequently, it proved convenient to investigate the kinds and sources of standards of achievement according to the patterns of managerial control. In many ways, costs are not so organizationally specific. All organizational units use materials, employ labor, utilize various services, and incur investment charges. Following the organizational pattern in the analysis of standards of cost would involve considerable repetition. Here it becomes more convenient to follow the patterns of managerial planning—to organize the discussion in terms of varieties of cost behavior. Consequently, the analysis of standards of real costs will follow the traditional three-fold division of cost accounting: materials, labor, and burden.

#### *Costs of Materials*

Materials needed by each organizational unit in performing each assigned task should be predetermined both qualitatively and quantitatively. Qualitative standards of materials costs are related to standards of achievement in two ways. The kind of materials must be appropriate to the required accomplishment. 'This is partly a matter of function, partly one of style, and partly one of cost. Many

articles are made of steel because of its strength and cheapness. Aluminum replaces steel where lightness and resistance to rust are needed. Plating or painting may be used to resist corrosion or to enhance the beauty of an object. Hair is used in some instruments because of its reaction to atmospheric humidity. This is a matter of matching requirements of a situation with properties of available materials. Ascertainment of requirements and preparation of specifications are the work of the product design section of the engineering department.

Second, materials costs of one company are usually product achievements of another. When an enterprise produces items conforming with certain specifications, these specifications are standards of qualitative achievement. If an enterprise purchases such items, the specifications become qualitative standards of costs. Consequently, the discussion of qualitative aspects of procurement department achievements applies here with equal force. As noted before, these qualitative aspects include such matters as tensile and compression strength, density, malleability, corrosion resistance, conductivity, color, finish, machinability, and many more factors.

The quantity of each material per unit of achievement must also be estimated. Standards of direct material usage can often be calculated by the engineering department. Layouts are made on sheet stock (sheet metal, leather, cloth, paper, etc.) to determine how to cut material to obtain the greatest yield. Such layouts can also provide a very accurate estimate of the amount of material required per unit of product. Other materials may be estimated wholly in terms of lengths required of standard cross sections, *e.g.*, railroad rails, bar stock for screw machines. Yet others can be accurately predetermined in terms of weights required, *e.g.*, castings, sand, gravel, cement, sawdust, and the powders used in powder metallurgy and in plastic molding. The hardest part of such estimating is usually determination of allowances for spoilage.

Occasionally subordinate executives exercise discretion with respect to quality or quantity of materials used. They may deliberately incur greater spoilage by using inferior materials because the saving from lower material prices more than offsets losses of labor and machine time processing material later found to be defective. For example, quarter-hard sheet steel may be used with a double-drawing operation instead of dead soft with a single-drawing operation if the quarter hard is enough cheaper more than to compensate for the

extra labor and machine cost of the second drawing operation and the extra spoilage frequently accompanying the use of harder stock.

### *Standards of Labor Cost*

Operations also exhibit qualitative and quantitative aspects. Both setup and operating labor are divided into qualitative jobs of different values and quantitatively measured in hours required to complete

Drawing No. _____	<b>MASTER ROUTE CARD</b>	Part No. _____
Description _____		Used In _____
Economic Run _____	Travel Time _____	Location _____

BILL OF MATERIALS				
Description of Materials	Symbol	Bin No.	Unit	Quantity/c

Oper. No.	OPERATION	Dept. No.	Mach. No.	Tool No.	Fixture No.	Gauge No.	Set Up Hours	Set Up Job Class	Oper. Hours/c	Operation Job Class
1										
2										
3										
4										
5										
6										
7										
8										
9										

FIG. 2. Direct labor and materials standards as shown by master route card.

the work. Thus each operation tends to require four labor cost standards: setup labor grade, setup labor hours, operating labor grade, and operating labor hours (see Fig. 2). The power shovel or adding machine of 1,000 parts averages nearly 10 operations per part, giving nearly 40,000 standards of labor cost for a single catalogue item. These standards are shot full of intangibles and judgments but are altogether necessary for effective managerial planning and control of processing operations. Something of the variety and sources of these standards will be presented below.

The tool engineering and methods departments analyze the work of product engineering in order to determine the sequence and nature

of operations required to fabricate each part and assemble each product. With due consideration to properties of materials specified and number of units involved, the proper machines, tools, and fixtures are designed and provided for each operation.<sup>8</sup> These determinations require thorough knowledge of materials, processes, machines, and tools. There is little cut and dried about such problems. Ingenuity and judgment play important roles. One company, for example, produces a fuse body on a four-spindle automatic screw machine. Cuts are heavy, and spoilage runs high. Another company uses a six-spindle machine with a greater number of lighter cuts and has virtually no spoilage. The sequence of drill, ream, countersink, and tap is often performed on automatic screw machines or on hand turret lathes and equally often assigned to a succession of drill presses. In either event, countersinking may be combined with either drilling or reaming if volume warrants use of combination tool bits.

These illustrations are mere symptoms. The entire field of mechanical technology is characterized by similar ambiguities. The factors involved are numerous and diverse, including such heterogeneous elements as size of run, available equipment, allowable tolerances, and quality of work force. For example, a single round piece will be turned by a highly skilled machinist on a standard engine lathe, using no fixtures and simple, standard tools. If thousands are produced, a skilled man will set up a turret lathe, using standard tools and simple fixtures. The job will be run off by a semiskilled machine operator. The vastly greater speed and lower operating cost will more than compensate for greater investment and setup costs. Tens of thousands will justify more complex tooling, including expensive, special fixtures and special-purpose, combination tools. Finally, a run of hundreds of thousands of pieces will be more economical on an automatic screw machine, requiring a much more skilled setup man, plus a skilled operator and an unskilled helper who will keep four or five such machines served. In punch press, assembly, painting, welding, packing, inspection, everywhere the story is the same; longer runs justify more expensive and more productive fixtures and tooling.

Qualitative operating standards include specification of machines, fixtures, tools, setup labor classification, and operating labor classification. Labor classifications are the product of job description, analysis,

<sup>8</sup> See L. P. Alford, *Cost and Production Handbook*, p. 232, The Ronald Press Company, New York, 1934, for a standard-practice instruction sheet exhibiting the detail of a single operation.

and evaluation studies.<sup>9</sup> The several methods advocated all require careful description of all work included in each "job," translated into human qualities or qualifications necessary to do such work, and extensive cross checking of evaluations to eliminate inconsistencies and absurdities. Basically all methods seek a relatively permanent agreement between unions, management, and individual employees on a wage structure fixing the relative rates for all jobs. All are loaded with judgments of intangible incommensurates, and all must make concessions to conditions in the labor market. For example, the rapid expansion of flame cutting and welding as a technique for building structural shapes has so expanded the demand for welders that an increasing supply has failed to keep pace. Consequently, on a basis of the factors included in job-evaluation studies, welders' wages are too high relative to most other skilled crafts. Regardless of the results of job-evaluation studies, enterprises must pay the relatively high wages or do without welders. None of the devices proposed to rescue job-evaluation plans from such conditions have proved very satisfactory. Figure 3 shows a relatively good job description and analysis.

Quantitative standards of labor cost are a matter of stipulating times allowed for each operation. These should always be divided between setup or make-ready times and operating times. Job specifications and wage rates for setup men are likely to differ from those of operators. Setup time is expended once for each order regardless of number of units in the order, whereas operating time is repeated for each unit produced. If setup and operating times are merged either in standards or in recorded performances, managerial planning and control will be handicapped and may become impossible.

Standard times are most effectively developed by motion and time study men in the methods department but may be derived from records of past performance or from foremen's guesses. Setup time standards

<sup>9</sup> Bengé discusses several methods and advocates the factor comparison method; see Bengé and others, *Manual of Job Evaluation*, Harper & Brothers, New York, 1941. Stigers and most others present and advocate a point system approach; see Stigers and Read, *The Theory and Practice of Job Rating*, McGraw-Hill Book Company, Inc., New York, 1944; or *Occupational Rating Plan for Hourly and Salaried Occupations*, Industrial Management Society, 1937. The classification system is best exemplified in civil service practices. Presentation of various approaches can also be found in more general works such as Knowles and Thomson, *Industrial Management*, Chap. 20, The Macmillan Company, New York, 1945; Scott, Clothier, Mathewson, and Spriegel, *Personnel Management*, Chap. 20, McGraw-Hill Book Company, Inc., New York, 1941; J. E. Walters, *Personnel Relations*, Chap. 6, The Ronald Press Company, New York, 1945.

Punch Press  
Setup Man

### JOB DESCRIPTION

Sets dies and removes dies from punch presses. Orders out necessary dies, and returns them to toolroom for repairs or refinishing or to storage upon completion of runs. Orders dies repaired or refinished during runs when needed.

### JOB REQUIREMENTS

#### *Knowledge*

1. Can set up and operate all types of punch presses including automatic dieing machine.
2. Determines dies to use, operator sequences, feeds, and speeds.
3. Uses all necessary measuring and gauging devices.
4. Understands working properties of brass, steel, copper, fiber, Bakelite, etc., with respect to cutting, stamping, forming, etc. Selects and sets up pre-heating devices. Selects coolants.
5. Selects and sets up necessary feeding hoppers, material-disposal equipment, safety devices, and air blasts for removing parts, chips, and cleaning of dies, etc.
6. Understands functions of complicated compound dies.
7. Understands blueprints and instructions for producing complicated parts.
8. Understands and uses charts, tables, and shop arithmetic.
9. Recognizes large number of punch press products and dies.
10. Understands relevant subsequent processes.
11. Gives routine instructions to operator on safe, efficient method of work on setups new to operator.

#### *Judgment and Responsibility*

1. Receives little supervision from foreman.
2. Reports inefficient or unsafe working practices of operator to foreman.
3. Studies foreman's plans with respect to production schedules, and arranges to have necessary material, dies, and equipment on hand at required time. Checks needed dies and equipment to ensure acceptable working condition when needed.
4. Sets up jobs, checks work in production, and makes necessary adjustments.

#### *Skill*

1. Makes close micrometer readings and other measurements.
2. Sets up to produce parts to tolerances of  $\pm 0.001$  inch.
3. Some setups are difficult and exacting.

#### *Experience or Education*

1. Equivalent to 2 years' high school, primarily to acquire ability to understand written instructions and to analyze problems.
2. One-year experience as setup operator on punch press or 2 years' experience as operator on punch presses.

#### *Working Condition*

1. Requires much lifting and walking.
2. Subject to minor cuts and scratches from handling sharp material. Also severe bruises and cuts due to carelessness in handling materials, dies, machines, and equipment.
3. Contact with oily material and equipment.
4. Noisy.

Fig. 3. Job description and analysis showing labor quality standards.

are more difficult to establish and less important, because less frequently repeated, than operating time standards. Consequently they are more often set from historic records or foremen's estimates. It is possible to build up setup time standards from standard elements and formulas much as time standards for die and tool work have been constructed.<sup>10</sup> For example, when the diameter of bar stock used in automatic screw machines is changed, the collet must be changed. An additional half hour is allowed for collet change as against a setup for a new job using the same diameter bar stock as the preceding job.

Operating times should usually be further subdivided between handling times and machining times. Time study techniques usually carry breakdown of handling time much further in an attempt to reach standard "elements" that can be recombined in various ways to give standard times for new operations.<sup>11</sup> For example, Barnes (page 290) gives the chucking and removing time for work held in a drilling jig by a thumbscrew as follows:

	Minutes
Pick up piece and place in jig .....	0.12
Tighten thumbscrew .....	0.08
Loosen thumbscrew .....	0.05
Remove piece from jig .....	0.08
Blow out chips .....	0.12
Total .....	0.45
(For each additional thumbscrew .....	0.07)

Machining times can usually be calculated from dimensions of work, properties of materials, tolerances required, and operating characteristics of the machine. Tables and formulas are available<sup>12</sup> showing best feeds and speeds for various tools and materials. For a given material, such as gray cast iron, and a given tool, such as a cemented tungsten-carbide facing tool, there are generally accepted standards

<sup>10</sup> See Ralph M. Barnes, *Motion and Time Study*, Chap. 21, John Wiley & Sons, Inc., New York, 1940.

<sup>11</sup> See *ibid.*, Chaps. 19 to 23. Also Lowry, Maynard, and Stegemerten, *Time and Motion Study*, especially Chaps. 24 to 35, McGraw-Hill Book Company, Inc., New York, 1940; W. H. Schutt, *Time Study Engineering*, McGraw-Hill Book Company, Inc., New York, 1943; P. Carroll, *Time Study for Cost Control*, McGraw-Hill Book Company, Inc., New York, 1943.

<sup>12</sup> Barnes; Lowry, Maynard, and Stegemerten; and Schutt have such tables. More detail is available in machinists' handbooks and in catalogues and books of direction issued by machine tool builders.

for depth of cut, rate of feed, and cutting speed. Such data and formulas enable calculation of cutting times for essentially all machine tools.

In general, built-up synthetic time standards are likely to be better than standards derived from direct stop-watch observations. Basic elemental data can economically be based on a vastly greater number of observations made under better controlled conditions and are therefore much more reliable and accurate. Operation standards based on such data are not so subject to errors of judgment of such factors as skill and effort. Stop-watch studies of different operations usually involve different operators and require adjustment, or "leveling," for differences in skill and effort. These adjustments depend upon the judgment of the time study man and from day to day may reflect the state of the time study man's digestion or marital bliss quite as much as the skill or effort of the operator. It is only fair to add that an effort is being made to make such judgments more objective by continual reference to motion pictures depicting standard levels of skill and effort. Finally, once the data are gathered and the formulas developed, synthetic standard setting does not require so much experience and exhaustive knowledge of materials, machines, and processes as does the stop-watch method. If the synthetic method is done well, its results are almost certain to be more uniform and consequently give rise to fewer grievances than the results of separate stop-watch studies.

Times for operators and machines are not necessarily identical. One man may tend several automatic machines. Other machines may require the full time of one man with occasional help from another. The possible combinations are varied and sometimes intricate.

### *Standards of Burden*

Burden, indirect, or overhead costs are a heterogeneous lot. Physical standards associated therewith are multitudinous, varied, and difficult to reduce to an ordered classification. Nearly all burden standards are relatives—costs relative to achievements, relative to other costs, or relative to investments. For example, the plant division is required to maintain minimum standards of lighting intensity, of temperature, of air changes per hour, and sometimes of humidity. Each of these achievement standards implies associated burden costs,



which should also be planned and controlled in terms of standards. Purchasing department costs tend to be closely associated with the materials costs of processing departments; personnel department costs with labor costs of other departments. Many maintenance department costs and many financial costs are determined largely by enterprise investments, and the cost standards consequently stated relative to the kind and magnitude of the investment.

As an example, consider the cost standards associated with building space. There are a group of standards pertaining to the problem of how much space is required (if space is rented, these are cost standards; if owned, investment standards). Machine dimensions determine one important component of space requirements. The numbers of each machine required are calculated from operation time data and exploded sales budgets. Then templates are prepared, layouts experimented with, and building requirements worked out. The number of employees, again based on operating time data, determine requirements for lockers, toilets, wash basins, etc., which, multiplied by appropriate dimensions, fix another major component of space requirements. Widths of stairways and area devoted to cafeteria also depend upon the number of employees. Storage space depends upon inventory requirements. Office area requirements depend upon the types of routine; the documents, records, and reports prepared; and the number of clerks needed to perform this work.

The costs associated with provision of these floor areas are also subject to a great many physical standards. From data specifying machines and buildings, requirements for power, light, heating, ventilation, compressed air, water, and other services can be calculated. There are accepted standards of lighting intensities for various kinds of work, for number of air changes per hour, and for locker, toilet, and washroom facilities. Tables are available showing heat losses per square foot through various types of building walls, windows, doors, and roofs. Many standards of maintenance run in terms of building areas: square feet of floor swept per hour, square feet of windows washed per hour, gallons of paint per square foot of wall or ceiling, etc.

Other burden costs depend upon the number of employees. In addition to floor space factors related to personnel, the number of employees affects such clerical costs as are incurred for compiling pay rolls, keeping personnel records in good order, and administering

employment tests and interviews. Costs of first aid and safety programs and employee recreational programs depend primarily upon the number of employees involved. And this does not begin to exhaust the list of real costs, planned and controlled in terms of physical standards.

#### STANDARDS OF INVESTMENT

Standards of achievement must be met without exceeding standards of cost or standards of investment. The factory manager must meet his output quotas without excessive labor cost and without overinvestment in machinery and equipment. Investments subject to planning and control can be classified as current or as fixed capital.

##### *Physical Standards of Current Investment*

Most current assets are pecuniary rather than physical. Thus cash, receivables, and short-term investments in securities are all measured solely in financial terms. The inventories alone are subject to planning and control in terms of physical standards. There are two dominant plans for controlling the size of inventories: the stock limit plan and the budgetary plan.

The stock limit plan involves setting an economic lot to purchase or produce and an ordering point for each item in the inventory. The economic lot size<sup>13</sup> is analyzed in considerable detail in Chapter 9. The order point depends upon the economic lot size, the rate at which the inventory is used up, and the time required from placement of an order to receipt of goods in the stock room. If usage is at a uniform rate and estimated "travel time" reliable, the period between orders is given by dividing the economic lot size by the daily rate of usage. If this period is greater than the time required to receive an order, the theoretical ordering point would be found by multiplying the travel time by the rate of usage. If less, the ordering point would be found by deducting the economic lot size from this product, and the orders would overlap. Nonuniform usage and unreliable travel times require a margin of safety added to the theoretical minimum ordering point and determined by managerial judgment.

The budget plan substitutes budgeted rates of usage for past averages. Orders for economic lots are placed sufficiently far in advance to ensure receipt by the time needed. This may or may not result in "shingling" orders. The margin of safety to take care of

<sup>13</sup> The term *maximum* is often misused to connote the sum of the economic lot size and the ordering point. The economic lot size is often called the "quantity to order."

errors of prediction takes the form of ordering a few days before the theoretical date instead of appearing as an increase in the ordering point.

### *Physical Standards of Fixed Investment*

Standards of amount of investment required have been reasonably thoroughly discussed in connection with standards of labor and space costs. There are also qualitative physical standards of investment. Many firms standardize on sizes and makes of machinery and equipment, *e.g.*, a single make of typewriter throughout the offices or a single type of truck. This policy facilitates maintenance of stocks of repair parts, provides flexibility through interchangeability, and simplifies repair operations. Even where none of these factors are operative, appearance may require uniformity, as in office furniture, or one type may be found outstandingly efficient—one enterprise has standardized on rigid-frame, single-story, trussless factory buildings with uniform 80-foot bays.

### CONCLUSION

This is not the place to review all physical standards meticulously. A fair-sized library can be built exclusively of existing books on materials and product standards. Nor is the literature on operating or maintenance standards deficient. Nor can this chapter definitively treat the establishment of standards. In a sense nearly all engineering is devoted to this task. The job of this chapter is to present the general nature of such standards, together with something concerning their sources. An understanding in this area is necessary for appreciation of analyses presented in following chapters.

Here are the elements that are classified and resorted into alternate managerial plans. These are the elements which must be priced out according to the calculus of increments and opportunities—presented in the next chapter. These are the standards which enable a management to police operations at the source. In the following chapters we turn to the evaluation and uses of these building blocks of managerial planning and control.

### RELATED READING

See footnotes 3, 4, 8, 9, and 11 in this chapter.

GRANT, E. L.: *Principles of Engineering Economy*, The Ronald Press Company, New York, 1938, especially Appendix A and references on cost estimating (p. 422).

## CHAPTER 6

### INCREMENTS AND OPPORTUNITIES

Purposes of the chapter: to investigate the financial behavior of the operational elements of managerial planning and control, to exhibit the fallacies of conventional cost allocations, and to find methods of estimating pecuniary cost behavior along many representative dimensions of managerial problems.

Chapter 6 continues the analysis of managerial techniques of planning and control begun in Chapter 5 and is concerned largely with the financial implications and interpretation of the physical elements partially catalogued and analyzed in Chapter 5. Although many physical standards are interchangeable among alternate programs of future activities, their financial implications shift from plan to plan in response to changing purposes and changing situations. These shifting evaluations may become amazingly complex.

#### ELEMENTS OF COMPLEXITY

The discussion of productive resources in Chapter 3 showed the major elements of complexity to be the following:

##### *Joint Purchases and Sales*

Cost items are purchased in bundles. After acquisition, the bundles are broken and fragments of various bundles are qualitatively changed in character and recombined in new patterns to obtain marketable commodities—themselves new bundles of fragments. As purchased bundles are exhausted, they are replenished by further purchases. The result is a complex of overlapping, intermingling cycles of varying lengths. Conventional cost accounting attempts to trace costs from the purchased bundles through the fragmentation and recombination process and into the sale units.

##### *Physical Nonproportionality*

As a basis for this tracing process, conventional cost accounting assumes a proportional relationship between physical input (materials,

labor, and services) and physical output (product). The assumption errs in two respects. (1) Both input and output tend to be non-homogeneous aggregates of finite, discrete quanta. Adding a unit of one item of input may or may not add units to one or more items of output. It is seldom possible to add a flat percentage to all items of input; and if possible, there is no assurance that an equal percentage would be added to all items of output. (2) Superimposed on the "jerky" character of input and output increments is the effect of the law of decreasing returns. Adding units of an item of input tends to produce progressively smaller increments of output.

### *Pecuniary Nonproportionality*

As a basis for tracing costs, conventional cost accounting assumes a proportional relationship between physical and pecuniary input. This assumption errs in three respects. (1) It ignores such discontinuities as quantity discounts and overtime wage premiums. (2) The influence of time and interest rates are neglected. (3) The irreversibility of some cycles produces fixed or sunk items not adequately handled by conventional cost methods.

### *Dependence on Dimension*

Conventional cost accounting assumes a unique truth, independent of purpose and of many aspects of situation. Each cost item, at every stage of the process of division, qualitative change, and recombination, is assumed to have a single, absolute value easily ascertainable by ordinary arithmetic processes of division and addition. Cost items should be given different values according to the managerial purpose to be served, *e.g.*, one set of values in determining prices, another in deciding whether to make or buy parts. Values also vary with situations; *e.g.*, in pricing, it makes considerable difference whether plant capacity is fully or only partially utilized.

### *Dependence on Time*

The growing frequency of division of costs by accountants into fixed and variable components may show the beginning of an awakening to economic and managerial problems. However, thus far the development has been damned by a philosophy of absolutism, a search for a single-valued truth, an assumption that a single division of costs between fixed and variable components can be found that will be true for all purposes and under all conditions. As has been previously indicated, the division between fixed and variable shifts with the span

of anticipation. All costs tend to be fixed if the time contemplated is short enough, and all tend to be variable if enough time is allowed.<sup>1</sup> Furthermore, a cost may be fixed with respect to one problem and variable with respect to another. The discussion of cost items that follows amply demonstrates these principles.

### CRITIQUE OF CONVENTIONAL PATTERNS

#### *Prime Costs*

The accounting for direct material and direct labor appears almost too simple and straightforward to conceal substantial errors. Cost accounting for direct materials usually involves setting up a perpetual inventory account with each item, debiting receipts as shown by receiving tickets, and crediting issues as shown by requisitions, the associated charges being made to jobs, processes, or products. On the physical side, no theoretical difficulties are encountered. Each account includes strictly interchangeable units. Consequently, acquisitions can be added to the balance and issues deducted, leaving a running balance of unmistakable meaning.

The financial aspects of receiving and issuing present grave difficulties. Assume a certain quantity is purchased for a certain sum. Both quantity and cost can be entered as plain statements of historic fact. The purchased quantity can be added to the existing balance without complicating the interpretation of the resulting total and without introducing arbitrary conventions. But when the cost of this purchase is added to a running dollar balance, major difficulties arise. The various purchase lots included in the account may have been acquired at different prices. From many points of view, the pecuniary total then becomes a nonhomogeneous aggregate of doubtful meaning. In all the generally accepted accounting methods this difficulty is ignored.<sup>2</sup>

The issuing of materials raises further difficulties. At what prices should materials be issued from stock to factory? The four generally accepted answers are (1) first-in, first-out; (2) last-in, first-out; (3) moving average; and (4) standard. All are simple and convenient rules. All reduce the dollar balance to zero whenever the physical supply is exhausted. Beyond these two advantages, discussions favoring the first three tend to lean on such semantic nonsense as "obvious"

<sup>1</sup> See Clark, *Economics of Overhead Costs*, University of Chicago Press, Chicago, 1923; also Specthrie, *Industrial Accounting*, Chap. 24, Prentice-Hall, Inc., New York, 1942.

<sup>2</sup> See footnote on p. 42 quoting DR Scott.

or "natural" and appear to be seeking some sort of dogmatic absolute truth.<sup>3</sup>

Arguments for the use of standard prices run in terms of establishing more effective managerial control over the use of materials and in terms of providing a basis for price policy free from random fluctuations. While the resulting "cost" figures are frequently used by managements in attempts to plan or to choose among rival plans or to control operations, none of these four methods of apportioning materials costs to jobs, products, or processes is ever defended on the ground that the method is appropriate for such purposes. And as a matter of fact, none of the four is adapted to the needs of managements confronting problems of choice or of control. None makes any attempt to report facts as to the laws of behavior of materials costs.

Cost accounting for direct labor customarily involves time tickets showing hours spent by each man on each job and number of pieces finished. The hours are multiplied by the man's hourly rate or the pieces by the piece rate, and the result charged to the job, process, department, or product. Weekly rates are typically divided by the number of hours in a work week and applied to various cost units exactly as if they were true hourly rates. Overtime premiums may similarly be charged to the cost unit but more often are charged to an overhead account and prorated over all cost units as a part of the burden rate. Wages paid for idle time are usually charged to an overhead account and later prorated as part of the burden rate to all cost units.

These cost procedures for direct materials and direct labor rest, at least partially, on the implied assumption that the financial cost aspects of material usage and labor application parallel (are proportional to) the physical and temporal aspects. There are numerous situations where this assumption is mischievously false. The analysis of such situations will be organized under the following headings: (1) prime costs fixed or sunk, (2) qualitative differences in applications, (3) joint prime costs, (4) quantity discounts and overtime premiums, and (5) carrying charges.

*Prime costs fixed or sunk.* Whatever materials may be from the point of view of income tax or of renegotiation of war contracts, from the point of view of managerial planning or control, materials are

<sup>3</sup> Van Sickle argues that first-in, first-out valuation of inventory gives a true value; that first-in, last-out also gives a true value; but that the moving average (which always lies between) contains a small error. *Cost Accounting*, p. 37, Harper & Brothers, New York, 1938.

often sunk costs. An extreme example is the firebrick manufacturer who found competitors buying large areas producing suitable clay. In considerable haste, the company purchased or leased land from which it had been getting its clay. After acquisition, drilling revealed sufficient clay to provide for all reasonable needs of the growing company for more than 300 years. For purposes of managerial planning, this company should regard the original cost of acquisition as a sunk cost. Any use that will more than pay the costs of digging, processing, and distributing is economically justified provided it does not "spoil the market." The purchase price of the clay in the ground has no significance for managerial planning, although traditional cost accounting would include it in the "cost" of the product. Nor should management incur costs to control waste of such redundant raw material.

In many businesses, analysis of inventories has disclosed extreme lack of balance. Some castings and piece parts may be on hand in sufficient quantities to provide for all normal requirements for 20 years or more. Impending design changes may indicate probable obsolescence long before the stock on hand is exhausted. For purposes of managerial planning, such items should usually be figured at opportunity cost, usually at scrap value.

Often replacement parts are carried in service department inventories to repair discontinued models sent in by customers. If this inventory is small enough relative to usage, special runs may be necessary from time to time, and the "planning cost" (here replacement cost) of such parts may be greatly in excess of their "original cost." If the inventory is so large relative to usage that no further shop runs are anticipated, "replacement cost" is no more justified as a basis for planning than "original cost." Such parts have a "planning cost" equal to resale value, commonly scrap value. All labor and burden originally charged to the parts have become sunk costs. Prices, of course, have little to do with planning costs in such instances, as the seller is usually in a monopolistic position and can charge what the market will bear without disproportionate sacrifice of good will.

During slack periods, companies may retain personnel in idleness or doing lower grades of work. In small companies and in small departments of large companies, labor may have substantial idle time without permitting a reduction in pay roll. In such instances, direct labor becomes a fixed cost, independent of substantial fluctuations in volume of product. In these circumstances, the behavior of direct



labor costs is at variance with the assumption implicit in traditional accounting methods; labor cost does not vary in proportion to time worked.

A Chicago company, selling about \$100,000 annually, has two factory employees. Current conditions in the labor market make employment of part-time help difficult, and variations in daily loads make it undesirable. Both men are paid a straight salary based on a 40-hour week. Production could rise nearly 50 per cent without making a third man necessary and could fall perhaps 25 per cent without enabling reduction to one man. Furthermore, one man presently employed is an elderly qualified chemist, the other a young common laborer. Neither can do all the kinds of work required of the other.<sup>4</sup>

Here, labor, as well as nearly all overhead, is substantially a fixed cost. In this company, most planning (except short-term financial planning) properly ignores direct labor cost, at least where short-run considerations dominate. For example, a New York outlet is served by the Chicago company on a cost of materials plus 10 per cent basis to help absorb some of the fixed costs of direct labor and other overhead. The Chicago company would not agree to a long-term contract on this basis, as they anticipate rising volumes of full-price items that will eventually absorb full capacity. If volume does rise, a choice will have to be made between adding another laborer and discontinuing service to the New York outlet. This, in turn, may depend on a managerial decision in New York between paying higher prices to the Chicago company and seeking other sources.

Other problems of this company are also resolved by computations in which direct labor is treated as sunk or fixed. Management spends its time on sales, wasting little effort on control of labor cost. Certain items are purchased in less completely processed form because labor for processing is, in effect, free. Increasing volume may result in buying these materials at a more completely processed stage. This is evidently a third alternative to be compared with adding more labor or discontinuing service to the New York outlet.

Thus, while traditional accounting usually reports "original cost" for direct materials and direct labor, "planning cost" tends to be incremental, replacement, or opportunity cost, depending upon circumstances. Where materials, labor, or burden costs have become fixed or

<sup>4</sup> This is not an unusual circumstance. The same reasoning commonly applies to heat treating, plating, painting, and many other departments of much larger companies. Such departments often consist of a trained foreman and one or a few unskilled laborers.

irretrievable, historical cost loses relevancy and opportunity cost should be used as the basis of managerial planning.

*Qualitative differences in application.* The presence of quantity discounts, joint demand, sunk costs, and finite units makes possible large differences between market price and value to the buyer. Since each use of materials and labor cannot be carried precisely to the point of indifference where marginal cost is exactly equal to estimated value, the estimated value of the same productive agent can vary substantially as among alternate uses.

For example, in buying firebrick, a company buys enough to line a furnace. A stand-by boiler may require the same amount of the same grade of material as one in constant use. The values to the company in these two uses may be very different, yet the company buys enough for both uses, paying a uniform price per pound. The joint demand for furnace lining, furnaces, boilers, coal, etc., together with the large finite character of the unit (one furnace lining) make approximate equality of cost and use value of the marginal unit altogether improbable.

Direct labor cost is rather more universally subject to similar considerations. Most men on hourly rates or on weekly salaries perform a number of functions or work on a number of different jobs. The highest class of work performed by an individual tends to fix his wage rate or salary level.<sup>5</sup> Often there is not enough of that work or even of that grade of work to constitute a full-time job. Consequently, each such man is assigned other and inferior grades of work until he does have full-time work. In such circumstances, every hour of the man's work, though paid at the same rate, is not of equal cost. Reduction of an hour's time on any job performed by a man does not save his rate for an hour. Typically, it enables him to do an hour's more work on some other task, and the saving of an hour's time should be measured by the value of this added hour's product. The added hour tends to be added at the margin, i.e., to be the least valuable hour's work performed by the man.

An exception occurs when the saving eliminates the highest grade of work performed by an employee, making possible replacement at a lower wage rate. Here the cost saved is not measured by the hourly rate multiplied by the number of hours saved but by the reduction

<sup>5</sup> Many company-union contracts provide for payment of higher rate for temporary transfers to higher rated jobs and for retaining worker's regular rate for temporary transfers to lower rated jobs.

in rate times the total number of hours plus the value of the added work performed during the time saved.

Returning to the chemist and common laborer illustration of the section above, time savings were valueless because total wages were fixed and idle time already existed. If it is assumed that the chemist must be hired full time and paid chemist's wages full time but that market conditions permit hiring common labor on an hourly basis, his wages ceasing whenever the laborer is sent home because of lack of work, the situation and the correct valuations become very different. Each hour of chemist's time saved is "worth" an hour of common laborer's time, because the chemist will be kept busy full time filling in with common laborer's work and the common laborer will work correspondingly fewer hours. However, if the company can finally eliminate the last hour per week of chemist's work, the chemist will be replaced by a common laborer, and the saving will be equal to the difference in chemist's and laborer's wages per week plus the time saved valued at the rate paid common labor.

*Joint prime costs.* Joint costs are perhaps more common than the frequent use of the beef-and-hides type of illustration suggests. Joint costs are the rule rather than the exception, not only in meat packing, but in many chemical industries, mining, and practically all salvaging enterprises. By-products are merely joint products of secondary importance. Even "scrap" is actually a joint product.

Since a joint product automatically accompanies other products, replacement cost will have no clearly defined meaning and cannot serve as a basis for managerial planning. Each joint product must sell for more than the cost of processing after separation, or the product should be discontinued. All joint products together must sell for enough to cover the aggregate of all costs, joint and separate, or the entire venture should be abandoned. However, at every stage of processing of each joint product (as with other products), opportunity costs should be included in computations made to determine whether to sell at that stage or to process further and toward what end products such further processing should be directed.

Labor cost incurred on joint products before separation or during the separation process is subject to the same analysis as joint direct materials costs. There is no unequivocal rule for assigning such costs to jobs or products. Problems of choice involving costs of one joint product inevitably involve costs and incomes of the other and must be solved in terms of total income and total costs associated with each alternate plan—each plan perforce covering all joint products.

*Quantity discounts and overtime premiums.* Some companies endeavor to obtain all of a customer's trade by giving discounts based on annual volume of purchases. There are some reductions in book-keeping and selling expenses that give color of equity to the practice.

More frequently, quantity discounts are allowed on orders exceeding certain magnitudes, or penalties are attached to orders below certain amounts. A delivery or service charge may be made on small orders, or a minimum order may be established. Quantity discounts are usually stated in the form: "\$1.20 per pound on orders below 100 pounds; larger orders at \$1.10 per pound." Less frequent, but avoiding charging a smaller total for larger orders, *e.g.*, 99 pounds for \$118.80; 100 pounds for \$110, is the practice of selling in blocks, *e.g.*, \$1.20 per pound for the first 100 pounds and \$1.10 per pound for all pounds in excess of 100.

From the buyer's point of view, these practices introduce a discontinuity in the curve of materials costs (see Fig. 4):

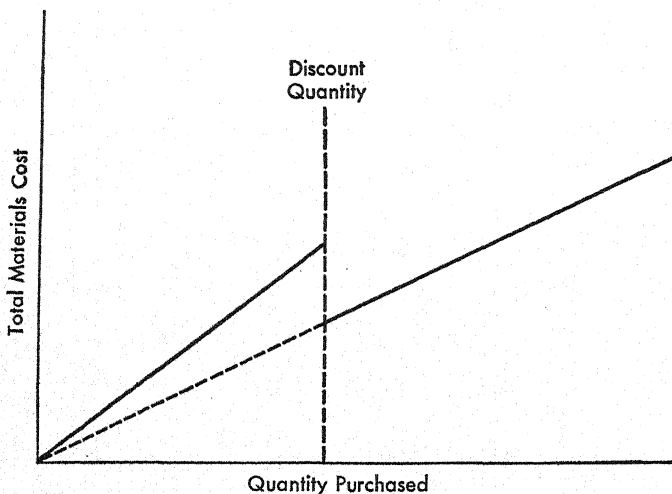


FIG. 4. Discontinuity due to quantity discount.

Above or below the discount quantity, the accountant's traditional assumption of cost proportional to quantity may hold true. Thus, below the discount quantity, a reduction in physical volume of purchases causes a proportional reduction in cash outlays for materials. Above the discount quantity, an increase in physical volume results in a proportional increase in cash outlay. The cost is truly variable in both instances. But if the marginal variation crosses the discount

quantity, the traditional assumption of proportionality of cost to physical volume is upset. In extreme cases a small increase in physical volume may cause an actual reduction in cash outlay.<sup>6</sup>

Where volumes are barely sufficient to obtain a discount or avoid a penalty, the "cost" of each unit purchased is largely a matter of managerial intention.<sup>7</sup> If management alleges that certain items were acquired "because they were essentially free," there is no better authority for another value. Obviously the entire cash outlay is the cost (not value) of the aggregate purchased. No single item "cost" more than the gross price per unit, but some items may have "cost" less than the net price. Mathematically, the price of some items could have been negative; e.g., the company bought them to obtain the discount and later had to pay to have them removed. This would be wise if the cost of removal were less than the saving from the discount.

Such dependence on management's statement of intention is not desirable or reasonable in tax work, in figuring cost plus contracts, in renegotiating war contracts, or in making loans. But for purposes of managerial planning, management's intention (as well as its judgment) is allowable, since management is itself the only user of these data.

The customary spreading of overtime premiums through allocation as a part of overhead is freighted with mischief for all planning operations. Repeatedly, managements (and governments) authorize work on the basis that it is worth more than it costs, cost including labor cost containing a pro-rata share of overtime premiums. Yet refusal to undertake such work would save labor at full overtime rates. Consequently, whenever overtime exists, management (and government)

<sup>6</sup> A company offered annual quantity discounts that sometimes gave such a result. In such instances, a salesman would call the customer and take an order sufficiently large to give the customer the benefit of the annual discount. The customer would get such an order free and might, if he were near enough the discount volume, receive an additional credit on future orders.

Some years ago another company had a price schedule containing a sharp quantity discount at the carload level. As a consequence a minimum carload of 62 drums was billed at the same total that a less than carload shipment of 45 drums figured. Occasionally orders would be received for intermediate amounts. These were usually filled with a carload shipment of 62 drums. On one occasion a customer insisted on receiving the amount ordered because of difficulties in making changes in appropriations and records in which the higher price had already been entered.

<sup>7</sup> Canning, *Economics of Accountancy*, p. 111, The Ronald Press Company, New York, 1929, "At best, intentions are a relatively unimportant matter; it is the statistical effects of a procedure that are significant." Here the intention governs the statistical effects.

should plan in terms of whether each particular job is worth the full *added* costs, including all overtime premiums avoidable if the job is not undertaken.

For social planning or socialistic organization, payment may properly be based on average cost, but planning and control should run in terms of incremental costs. Particularly in view of the acute labor shortages accompanying modern war, it is highly desirable that Army, Navy, and other governmental procurement departments plan and act as if each contract would cost the full incremental cost, often including all labor at overtime rates. In such circumstances, the output of whole trades, companies, and industries should be computed, for planning purposes, as if all direct labor involved were paid the overtime premium rates. Any hours saved are always saved at the margin; *i.e.*, rescheduling always results in saving overtime hours. This should result in abandonment of secondary projects and undoubtedly would result in considerable shifting in proportions of the items ordered. Current cost keeping, with its undercharges for direct labor, tends to result in too large a proportion of items in which the ratio of labor to total costs is too high. Proper calculation would divert some labor, materials, and capital to other items with lower ratios of labor to total costs. This would tend to balance the load on fixed capital (facilities), which tends to be underutilized owing to scarcity of materials and, more particularly, to scarcity of labor.

Managerial control is sometimes sought by giving bonuses to supervisors, calculated as a percentage of savings in materials, labor, and burden costs. To make such bonuses truly reflect the welfare of the company, "savings" should be calculated in terms of changes effected in total costs. Where prime costs are fixed, no bonus should be paid for saving pounds of materials or hours of labor. Where overtime hours are saved, bonuses should reflect overtime rather than average wage rates. Where quantity discounts are involved, such bonuses should reflect materials savings at incremental rather than average prices.

*Carrying charges.* Managers balance carrying charges against quantity discounts in deciding how large material purchases should be. Where the discount quantity is at the managerial margin of indifference, the manager, in effect, values material for immediate use at the higher price of the smaller quantity and material to be used last at the added cost. Neither has entered the manager's plans at the average cost computed by traditional cost accounting.

Assume that an item costs \$10 per piece for orders of less than 1,000 and \$9 per piece for orders exceeding 1,000. Further assume that at \$10 straight, the manager would buy 500, but because of the quantity discount he buys 1,000, though essentially at the margin of indifference. Since 500 would have cost \$5,000 and 1,000 did cost \$9,000, the manager may properly figure he has paid \$5,000 for 500 and \$4,000 for a second 500. Furthermore, if at the margin of indifference, carrying charges on the second 500 will presumably amount to approximately \$1,000 before they are used. Consequently, for managerial price planning, the units may be figured at an "actual cost" of \$10 apiece.

It is probably better for the manager to view the problem as a whole rather than on a per piece basis. The manager, having mapped out the alternate plans, can estimate the total enterprise profit and loss picture associated with each plan. These computations should reflect actual cost behavior rather than naïvely apply arithmetic without reference to purposes and situations.

### *Burden*

Factory burden is often allocated directly to jobs or products by means of an over-all, factory-wide burden rate applied in proportion to direct labor costs or to direct labor hours. Where departments vary considerably in the invested capital devoted to each, in consumption of power, in amount of maintenance required, or in intensity of supervision, the presumption is that application of burden to jobs or products through the use of departmental burden rates will be more precise. In this event, items of burden are first prorated to departments in proportion to a plausible underlying rule of causation, reallocated from service departments to processing departments and finally allocated from processing departments to jobs or products on a basis of direct labor costs or hours. Though probably irrelevant, the contention does indicate the need for considering the problem of allocating burden items to departments and "departmental burdens" to jobs or products separately. Accordingly, this section will first analyze allocation of several typical items to departments and conclude with an analysis of application of departmental rates to jobs or products.

*Supervision.* The superintendent's salary and other general supervisory expenses are usually allocated to departments in proportion to direct labor hours or to direct labor cost. Yet some departments require almost no supervisory time or effort, while others show unusual ability to create knotty problems. Certainly proportional allocation does not result in reporting the dollars that would be saved by dis-

continuing the department. Where discontinuance is the managerial problem at issue, cost accounting typically reports misleading data.

If the managerial problem is one of controlling foremen, allocation of superintendence cost according to direct labor hours or cost is again misleading. Each foreman may exercise some control over labor hours expended in his department, but his share of the superintendent's salary will be largely influenced by what other foremen accomplish in their departments. And, of course, he has no control over the salary paid the superintendent. Furthermore, a reduction in labor hours in a department may be caused by the superintendent's spending a disproportionately large amount of time and effort on the department. The customary allocation basis will result in a reduction in the amount of salary charged against the department under these circumstances, surely an inversion of the true picture.

An effort is sometimes made to allocate supervisory cost to departments according to distribution of supervisory time. The superintendent is asked to keep time tickets charging his own time to the various departments.<sup>8</sup> This practice invites at least three types of errors:

1. There is an implicit assumption that superintendents work at constant speed, thereby equalizing the values of all hours they work. Should time on Monday morning be charged at the same rate as on Saturday afternoon, regardless of differences in freshness and efficiency? Should a foreman be held responsible for his superintendent's sluggishness following an all-night binge? If the superintendent stays home because of illness, no time will be charged against any department, although his salary continues without diminution. If he comes to work when he should have stayed home, he gets little done but his time is charged at the full average rate to the department for which he happens to "work."

2. There is an implied assumption that all work done by the superintendent is of uniform grade or value. A superintendent's work, like that of direct laborers, covers many grades. He may be doing work essentially on a vice-presidential level one hour and relatively low-grade clerical work the next. Should a foreman be charged a superintendent's rate because his superintendent has not learned to delegate clerical work or has nothing more challenging to do for the time being?

3. A single-valued truth seems to be sought. Many texts (all that I have examined) and much practice (all that I have seen) attempt

<sup>8</sup> Speethrie, *op cit.*, p. 179.



to allocate supervisory expense without any reference whatever to the ultimate managerial problems for which data are being so expensively prepared.

*Rent.* Factory buildings are usually rented for a term of years at so much per month. Rent is usually apportioned to departments by dividing monthly rental by normal number of working hours and by number of square feet used. This gives a "cost" per square-foot hour. Night and holiday hours are charged at zero rate as are aisle square feet. The cost accountant's world seems black or white with no shades of gray. Either square feet and hours take the full average cost, or they bear no charge whatever. This situation is full of anomalies.

1. The rent bargain contains a large capricious element. In the higgling of the market, the landlord may suggest \$300 per month for a year, \$350 per month for the next, and \$400 thereafter. If this is agreed to, month by month the accountant gravely reflects each month's figure. Yet landlord and tenant could both have been equally satisfied with a constant figure, of, say, \$360 per month or with a rental equal to 4 per cent of gross sales each month. Whichever form the bargain happens to take has nothing to do with the actual cost per square-foot hour. Each form must have a level precisely equal to some level in each of the other forms. At this equilibrium, total cost is the same for each form, and square-foot-hour cost must be the same. But the accountant ignores these economic realities (except when total rent is paid by a single advance payment!) and gravely follows the form rather than the substance, showing the three equivalent situations at very different monthly valuations.

2. Given any form, different square feet have different values. A manufacturing enterprise may rent a five-story building with a single department on each floor. Typically each department would be charged the same rent, one-fifth the total. However, if each department were an independent enterprise, it would find its rent very different indeed. One such building charges \$150 to the first-floor tenant, \$90 for the second floor, \$80 for the third, \$60 for the fourth, and \$50 for the fifth. From the point of view of the building management, the differential is greater because of added elevator service costs for higher floors. When the five separate companies and the building corporation merge, do these differences disappear?

3. Hours are of different values. During peak seasons, production areas are congested and extra space is rented at high cost; and during slack seasons, storage areas are partially empty. Regardless of the

form of lease, can it be said that occupancy has the same value in peak and dull months? While ignoring all gradations, when such situations reach the limiting case, the accountants capitulate. Assume a town has excess store space, part of which was rented for selling Christmas trees for \$24 per year, payable \$2 per month. If the space were idle 11 months of the year, accountants would probably agree to charge the entire \$24 to December.

Planning problems run in terms of alternate courses of action. For example, should an enterprise compress present departments enough to install a plating department, should it acquire additional space, or should it continue to have its plating done outside? Should a company acquire additional space for storing stock produced in dull seasons, or should it meet peak season sales requirements by purchasing whatever it cannot produce currently? How does rent affect such problems?

It seems obvious that contract rent becomes a fixed cost, *i.e.*, irrelevant, as soon as the lease is signed. Thereafter, for purposes of managerial planning, most rent becomes an opportunity cost, additional space, however, being figured at incremental cost. What else can be done with the floor space during the time contemplated? How much will additional floor space add to total cash outlays?

Consider the installation of a plating department without adding to the total floor space utilized. How much rent should management figure as a cost of the plating department to determine whether the department should be installed or plating sent out? The immediate cost is evidently the increased congestion experienced by other departments. This, in turn, translates into increased material-handling costs (indirect labor), idle time in processing departments caused by interference and waiting for materials (typically short and frequent, consequently merged with direct labor on work tickets reporting time spent on each job), and increased carrying charges on a larger in-process inventory caused by slower progress of materials through the factory. The magnitude of each of these cost components tends to be a matter for expert opinion rather than for mechanical application of simple arithmetic rules.

If the building is owned rather than rented, contract rent is replaced by building maintenance, janitor supplies and wages, taxes, insurance, interest, and other miscellaneous cash outlays, plus building depreciation. In this event, the problem becomes much more complex, as each of these component factors follows different laws of variation, some of which may be affected by the managerial decision

under consideration. For example, the insurance rate may be affected by the type of occupancy under consideration, in which event the new department should be charged with the total increase in premium, not merely with a proportional part of the total premium based on the relative area occupied. These problems do not replace the problems discussed in connection with rented space. Varying costs due to varying congestion in areas occupied by each department will continue to be an important element in rational managerial choice among rival plans.

Additional cost and opportunity cost are relevant concepts. The cost reported as "rent" by typical cost accounting systems is irrelevant and misleading.

*Power.* Purchased power is customarily allocated to departments in proportion to kilowatt-hours consumed by each or, if sufficient meters are not available, in proportion to connected horsepower loads of the several departments. Either method ignores the laws of behavior of this cost.

A typical industrial rate<sup>9</sup> is composed of four separate charges:

1. A charge per kilowatt-hour. This component is correctly apportioned by traditional costing technique.
2. A demand charge based on maximum power used in any 15-minute period during the preceding 12 months.
3. A peak charge based on maximum power used in any 15-minute period between 4:30 and 6:00 P.M. on any day during the preceding 12 months.
4. A penalty for low power factor.

The demand charge is erroneously allocated by traditional costing technique. Many plants shut down certain pieces of equipment at certain times to avoid increasing the demand charge for the entire ensuing 12-month period. One such plant has assigned to the engineer in charge of its heating and power plant the duty of maintaining a watch on a demand meter. Whenever the maximum demand level is approached, he telephones a department operating a large metal saw and orders the saw shut off. Later, when demand drops, he telephones again to give permission to start the saw. Consequently, this saw never contributes to the demand charge. Yet, following custom, the cost accountant allocates a considerable fraction of the demand charge against the metal-sawing department because of the large proportion of total kilowatt-hours used by the department. The department is

<sup>9</sup> Rate D, Western United Company, 1935.

given no relief from extra costs of disrupted schedules and idle labor and machine time caused by such shutdowns.

The peak charge is often misleadingly allocated to departments. The metal saw discussed above was always shut down from 4:30 to 6:00 P.M. to keep down the peak charge. It never contributed to these charges but bears a considerable portion because of its high kilowatt-hour usage. Nor is relief accorded from costs arising from difficulties of coordination with other departments.

A large electric furnace uses many kilowatt-hours but improves the over-all power factor of a plant. Under the customary allocation, this department would bear a large share of the power factor penalty because total power costs are usually allocated in proportion to kilowatt-hours. These errors are misleading and important when management faces problems of choice. Suppose management is deciding whether to install an electric heat-treating furnace or to send material out to be heat-treated. The kilowatt consumption of the proposed furnace is known, and the hours it will operate are estimated. The resulting kilowatt-hour load is typically multiplied by the average rate experienced by the company as reported in its cost records. Yet the power factor penalty portion of electrical cost should not be charged to the furnace at all. In fact, the unit power factor of the straight resistance load of the furnace may decrease this portion of the electric bill, and the furnace should receive a credit instead of a charge. Management may deliberately plan to operate the heat-treating department from 8 to 4 instead of from 9 to 5 to avoid the peak charge. If so, the plan to install heat-treating equipment should not be burdened with any part of the peak load charge. Operation of the furnace may not permit avoidance of periods in which new demand charges are set, and consequently this element may be chargeable to the department—rarely in proportion to kilowatt-hour consumption. Other equipment may be shut down during such periods, vitiating the kilowatt-hour ratio for this purpose. Demand charge should be allocated on its own ratio: connected horsepower likely to be in operation at the time new demand charges are set.

The problem of whether to produce or to buy power involves all the considerations discussed above with respect to purchased power plus many complicated questions of the behavior of costs of producing power. Producing power usually involves costs for fuel, labor, insurance, maintenance, taxes, interest, space, and depreciation, each of which follows its own laws of behavior. Most of these items have several dimensions, *i.e.*, vary for a number of different causes. Fuel,

for example, tends to increase with the amount of power produced but also depends on the load factor. Generating efficiency varies with load; more coal per kilowatt-hour is needed at low outputs than at high. Labor, insurance, taxes, interest, and space costs may be fixed, *i.e.*, irrelevant, within the limits of output of the equipment installed. By-product fuel may be available (at opportunity cost). By-product space heating may be secured, or power itself may be regarded as a by-product of process heating or of process steam generation.

All such problems involve not merely the problem of whether to produce or to buy power. Instead, complete programs covering all related activities should be formulated in detail. Then costs (and incomes, if any) of each program can be computed, and the rival plans compared. Remembering that the goal is total cost for each plan will resolve many pseudo-difficulties by making fictitious allocations unnecessary. If entire programs are evaluated, there will be no need to allocate costs as between processing, space heating, and power, no need to allocate raw-material cost between product and by-product power.

*Depreciation.* Traditional accounting favors depreciating each asset separately on a straight-line basis, *i.e.*, proportional to time. A few assets are usually depreciated in proportion to utilization, either working hours or units produced.

Different years have different values. Equipment may be used to capacity one year and at a relatively low rate another. A manager gifted with omniscience might buy a machine, knowing all the fluctuations in load factor in advance. He would not feel he was paying equal amounts for all years. He would figure the value of the equipment for each year, add these unequal values (making due allowance for compound interest), and buy the machine if the total was sufficiently in excess of the purchase price. Nor is the service unit method a complete answer to the problem. In slack seasons, equipment may be operated if it brings in a return considerably less than depreciation figured on a service life basis. Such a return might still be better than no return. Presumably this would be the return used by the omniscient manager in his calculations.

Managerial planning problems with respect to equipment are concerned with (1) whether to expand, (2) whether to contract, (3) whether to replace.

1. In considering expansion, management should think in terms of initial outlays at present market and depreciation based on such out-

lays. Book value of presently owned equipment reflects a past market price and is likely to be irrelevant. If the initial outlay is expected to be dissipated uniformly over the life of the asset, depreciation expense should be calculated according to the annuity formula. From a managerial view, the original outlay is the present worth of the scrap value plus an annuity (of valuable services) spread over the life of the equipment.<sup>10</sup> If these services are spread nonuniformly, accuracy would require estimating the value of services for each period and discounting each term of the series to present worth.<sup>11</sup> In practice, only major anticipated variations could be considered.

2. In considering contraction, management should think in terms of present resale values, and "depreciation" should be computed as a shrinking of the resale value. In such problems, original cost (or depreciated book value) is irretrievable and irrelevant, and consequently depreciation expense calculated on such a base is erroneous and misleading.<sup>12</sup> The only choice remaining to management is between selling the equipment at once for whatever it will bring or keeping it in use while the resale value diminishes.

3. Replacement problems involve both computations relative to prospective additions to equipment as in paragraph 1 and to disposition of old equipment as in paragraph 2. No new difficulties appear.

*Departmental burden.* The discussion of burden items above runs in terms of allocation to plans. If these plans concern departmental aspects of activities, the allocations automatically are to departments. If plans concern products, the relevant allocation is to products; but if production is organized according to product (mostly in continuous-process plants), this will coincide with allocation to departments. Where departments follow processing or functional lines, traditional cost procedures often allocate costs to departments as a first step toward allocation to jobs or products. A second step involves reallocation of service department costs to processing departments, and a final step allocates the resulting totals to products or jobs as they move through the departments. This section deals with the allocation of departmental costs to jobs and to products. (This discussion is not

<sup>10</sup> Finney, *Principles of Accounting*, Vol. 1, p. 276, Prentice-Hall, Inc., New York, 1934.

<sup>11</sup> See Canning, *Economics of Accountancy*, Chap. 13, The Ronald Press Company, New York, 1929.

<sup>12</sup> See Mitchell, *Production Management*, Chap. 7, University of Chicago Press, Chicago, 1931.

to be taken as a waiver of the criticisms of allocations to departments and to programs made in the preceding paragraphs.)

The allocation of departmental burden to jobs or to products usually is in proportion to hours spent on various jobs or products.<sup>13</sup> This runs into the difficulties similar to those discussed in other connections above: (1) departments perform various grades of work, and (2) hours have different values from a maximum at peak load through all values to zero during holiday shutdowns.

In the "most accurate" method of burden distribution, each machine or work place is regarded as a department, and the burden accounts are allocated to these "production centers" and thence, on an hourly basis, to jobs or products. Frequently the planning department will find that smaller or lighter equipment, *e.g.*,  $\frac{1}{2}$ -inch automatic screw machines, is loaded to capacity while larger or heavier equipment (1-inch screw machines) is relatively lightly loaded. Larger, heavier equipment usually uses more power, operates more slowly, and has a larger original cost. Yet management may have to decide among incurring overtime rates on light work put over appropriate equipment, scheduling some over heavier equipment, sending some out for processing, or delaying the entire delivery schedule. In terms of this problem, should the higher hourly rates of the heavier equipment be charged against the light work that may be run over it? The pragmatic answer appears to parallel that given for overtime wage premiums. Each light job *that might have been* transferred to the heavier machine ought to be figured at the out-of-pocket costs of putting it over the heavier equipment. These costs should be compared with the out-of-pocket costs of outside purchase and of overtime production on the appropriate lighter equipment. If any job is figured to be cheaper when purchased or made on the overtime basis, it should be transferred to the cheaper alternative. Note that out-of-pocket cost excludes much of the departmental burden accumulated by the cost accountant: rent, depreciation, insurance, supervision, taxes, and many more. Also, out-of-pocket cost will probably be different for light and heavy work run on the same equipment: power needed will differ, speeds will differ and carry certain costs with them, etc.

Another problem arises when work of varying quality is put over the same equipment. The initial cost and level of maintenance are largely determined by the degree of accuracy required for the finest work scheduled to the machine. Should rough work bear a share

<sup>13</sup> Specthrie, *op. cit.*, Chaps. 18 and 21.

of these costs proportional to hours used? The solution parallels the similar problem of labor (or supervision) spread over various levels of work.

In much the same way, different hours on the same machine have different costs. For example, certain hours participate in setting new demand or peak charges for purchased power. Other hours run into overtime wage premiums, not merely on direct labor, but maintenance and other overhead labor may be pushed into holiday time with consequent premium rates.

In every instance, no valid answer can be given until the ultimate managerial problem is clearly delineated. Since these are problems of managerial planning, clear delineation requires detailed description of each alternate plan. Then costs, both direct and burden, should be allocated to plans, each plan being regarded as an organic whole. If the problem is one of deciding whether a particular department should perform a particular operation on a particular job or the job should be sent out for processing, some burden accounts will have to be allocated to the department and then to the job.<sup>14</sup> This requires cross classification. Each departmental burden item account should be studied to ascertain its rule of variation along this particular dimension, both as to allocation to the department and as to subsequent reallocation to the job or product, and the allocation should be made according to the rule of variation discovered.

### *Income*

Business operations are intertwining, repetitive cycles of acquisition, division, use, recombination, and sale of productive energy. The attempt to place values on the intermediate stages by accumulation of costs proved complex and difficult—generally impossible. Consideration should be given the possibility of valuing “fragments of bundles of productive resources” from the final stage of the cycle.<sup>15</sup> The sale typically is for cash or a promise of cash. Thus valuation at the final stage has the same satisfying definiteness as at the initial, and the same difficulties are encountered in trying to relate values of middle terms to the terminal cash value.

Sale units are recombined bundles of fragments, and sale price is a joint income ascribable to the sale unit as a whole. The machinery

<sup>14</sup> Others may be allocated directly to the job, *e.g.*, special tooling or clerical costs of order handling.

<sup>15</sup> Canning, *op. cit.*, suggests the desirability of such valuations (direct valuations) for balance sheet items in Chap. 9.



for allocating this joint income among constituents of the product is again a matter of matching increments of product against increments of constituents and is again complicated by the finite nature of the units employed and by such discontinuities as are introduced by quantity discounts and carrying charges. Purpose and situation play similar roles in estimating values of intermediate fragments from whichever end of the cycle valuation is attempted.

#### COST RECORDS AS A BASIS FOR MANAGEMENT

Because it is misconceived, is misdirected, and attempts the impossible, traditional cost accounting is at once overelaborate, inadequate, and misleading. With the tradition wrecked and the ground cleared for a new structure, we turn to an analysis of what such a structure should be. How should cost records be kept to provide the variety and detail of data needed by management as a basis for effective planning and control?

##### *General Rules for Initial Recording of Cost Data*

As has been shown earlier, the pertinent classifications and evaluations of cost data depend upon managerial problems, *i.e.*, purposes and situations. Many problems will not exist or will not be recognized at the time of initial recording of data, and consequently the associated requirements as to classification and evaluation will be unknown at this time. For managerial planning and control, there is no single "right" hierarchy of classification of cost elements. What management needs from cost accounting is a reliable, detailed, historical record of the facts of business operations, so classified and evaluated as to enable management or accountant to rearrange the data as required by each emergent managerial problem. The accountants should not tamper with these facts. Opinion and judgment should be as rigidly excluded as possible. Opinion and judgment should take both the particular managerial purpose and its matrix situation into consideration, and neither is known at the time the records are made.

These considerations lead to three basic rules governing the initial recording of cost data:

1. Do not merge nonhomogeneous items. Segregate every item having a different behavior pattern, following a different law of variation along any dimension. For example, the factory ledger should contain separate accounts for accumulation of kilowatt charges, demand charges, peak charges, and power factor penalties instead of merging the four in a single "purchased power" account. Each follows a dif-

ferent law of variation as an enterprise changes from one program to another.

This rule applies only to the basic record, to the primary level of accounts. As long as these are maintained "pure" and accessible, any hierarchy of subtotals and totals may be erected for legal-financial purposes of accounting, for recurrent problems of planning or control, or for special problems. But the basic record should be left inviolate and easily accessible for later appropriate reclassifications to meet other problems as they emerge.

2. Do not divide and prorate or allocate homogeneous elements. For example, burden charges should not be chopped up and lost in a maze of allocations to departments, reallocations of service department charges to processing departments, and further reallocations to products, processes, or jobs.

This rule again applies only to the basic record. As long as homogeneous primary groupings are kept readily accessible, any amount of subsequent allocation (with merging of dissimilar allocated fragments) is permissible to fit various managerial and other needs as they become evident. Such divisions, allocations, and merging of data should reflect purposes and situations and consequently tend to be numerous and incompatible. Usually they are more conveniently handled outside the regular historical record.

3. Do not merge income or expense items pertaining to different departments, processing centers, or operations unless they originate as discrete quanta. These items should be assigned to the smallest operating unit not requiring arbitrary division and allocation. Kilo-watt-hour charges, most direct labor, and some maintenance items are examples of expenses that may be assignable to operations or to processing centers without imposing artificial conventions. Foremen's salaries illustrate expenses chargeable to departments but not to operations or processing centers without introducing arbitrary factors. Directors' and presidents' salaries are expenses pertaining to the enterprise as a whole. Alternate programs may differ as to their departmental, processing, or operational content. The accounting record should facilitate exploration of these differences.

These rules suggest a multiplicity of small, detailed accounts. While strictly homogeneous, being relatively small they will be conspicuously affected by random elements. Comparisons between periods on this detailed level are consequently likely to be meaningless. This is not serious, since once the managerial or other problem is

known, the detail can be gathered into an appropriate hierarchy of totals, which may disclose significant trends.

Maintaining an accessible basic record of factual details, unmixed, unadjusted, and undivided, facilitates

1. Making adjustments to fit each problem and each situation as each arises. Such adjustments will give full weight to engineering estimates, physical standards, and managerial judgment.

2. Cross classifications, correlations, and statistical analyses of cost behavior patterns. Such analyses will often prove a valuable guide to engineering estimates and managerial judgments. The appropriate classifications and correlations cannot be worked out until the problem of planning and its setting are known. Of course, some "fishing" may be done, experimenting with classifications, correlations, and trends in the hope of discovering significant managerial problems.

3. Building up hierarchies of subtotals and totals once an emerged problem situation provides a guide to the appropriate hierarchical pattern.

Costs and incomes may be allocated, on the basis of actual laws of behavior, to alternate programs after the problem has emerged. The record should show cost and income data of the recent past, so broken down and classified that after a problem has emerged, *i.e.*, alternate programs have been formulated, calculations of differences can be made, item by item, each following rules derived from observation of actual cost behavior.

### *Accounting for Direct Materials*

Typically, four records provide adequate information about direct materials.

1. As noted in the preceding chapter, complete bills of materials should be prepared for all products and for all parts. Each item listed on any bill of material should have complete specifications prepared. These specifications and bills of materials supply the physical standards that become component elements of managerial plans. They also become the standards by means of which management judges the performance of subordinates, the effectiveness with which the plans are executed.

These bills of materials and specifications are prepared by the engineering department. They are relatively permanent and should not change except by specific order of management. Meanwhile they provide a basis for many managerial calculations without necessitat-

ing the huge expenditures on clerical labor inherent in historical materials costs records.

2. A purchase record should be maintained with a page for each item, *i.e.*, for each specification. A record is entered of each lot purchased, showing source, quantity, prices, discounts, and any irregularities as to deliveries or acceptability of items. Since all entries concerning the same specification are entered on the same page, a comparative record is established providing a convenient safeguard against purchasing and disbursing errors. By means of this record, sources can be compared and purchasing policies enforced.

3. A perpetual inventory record should be kept in physical units covering all important items. Minor items can be placed on an order-point-quantity-to-order basis, with the order-point quantity separately packaged. This minimizes clerical work arising from receipts and issues of insignificant items and from maintaining perpetual inventory records of important items. It is doubtful if perpetual inventory records kept in financial as well as physical terms are ever justified.

The perpetual inventory record provides usage data as a basis for managerial planning and control and controls losses caused by carelessness or pilfering. When requisitions are issued for correct amounts as shown by bills of materials, spoilage is forced into the open. Spoilage compels a foreman to obtain a supplementary requisition to complete a shop order, and such a special requisition should attract sufficient attention to give management control of usage of materials in the shop. Physical counts compared with inventory records provide a check on the carefulness and honesty of stock-room employees.

4. Spoilage records should be maintained showing quantities spoiled, operation, operator, machine, tool, etc. Should such records reveal consistent spoilages by particular machines, tools, or operator, remedial action should be instituted. If persistent spoilage is traceable to certain operations, engineering designs should be reconsidered from the point of view of feasibility of production.

These four records provide information and control that are more economical, more pertinent, more flexible, faster, and more adequate than those obtained by the traditional charging of materials against processes or products or job orders. When alternate programs are being considered or quotations are being prepared, the physical amounts shown by bills of materials and specifications are priced at current market or at most recent purchase price shown in the pur-

chase record. Full consideration is given quantity discounts, terms, and all other pertinent factors.

### *Accounting for Direct Labor*

Typically, four records provide adequate information about direct labor:

1. As described in the preceding chapter, operation sheets are prepared for each assembly and each part. Labor hours needed for each setup and for one cycle of each operation should be determined and recorded in these permanent operation sheets. These sheets should also show machines, fixtures, gauges, and tooling required for each operation. Job specifications should be included for each setup and for each operation.

These operation sheets are prepared by the methods department. They are relatively permanent and should be changed only by specific order of management. They provide the physical standards that enter into managerial planning and become the standards by means of which management judges daily performances. Their use as a basis for plans and for quotations avoids the huge clerical cost of posting all time tickets to individual job-order cost accounts.

2. Permanent records should be maintained showing job descriptions, analyses, and evaluations. Like the purchasing record in materials accounting, job-evaluation records provide data needed for pricing the quantities used. This record also provides an adequate managerial check on utilization of labor by foremen and a basis for negotiating grievances arising in the shop.

3. Performance efficiencies should be recorded and promptly reported. Usually a separate sheet reports the efficiency of each department, with a separate line for the efficiency of each workman on each job. Columns carry data showing clock number, part number, operation number, machine number, standard job classification, job class of workman performing job, number of pieces produced, standard hours, actual hours, and percentage of efficiency.

These data are periodically reclassified according to workmen and filed permanently in the personnel records.

4. The spoilage records suggested for control of materials usage will also give management control over the qualitative aspects of labor performance.

As with material records, these labor cost records provide information and control that are more economical, more pertinent, more flexible, faster, and more adequate than those obtained by the traditional

charging of time tickets against products or processes or job orders. When alternate programs are being considered or quotations prepared, the labor hours shown on the operation sheets are priced according to the appropriate job rates fixed in the union contract. Full consideration is given any need for overtime operation, use of labor on fill-in work to maintain a work force during periods of adversity, and any other relevant factors.

### *Accounting for Burden*

Burden records should be classified and recorded in a manner providing adequate flexibility in grouping and regrouping data. Each primary class should be homogeneous with respect to every significant dimension of managerial problems of planning and control. Some of the major dimensions along which burden may vary are number of units of output, number of orders, number of operations, capacity of plant, number of catalogue items offered, and span of anticipation. Corresponding expense items in different departments may follow different laws of variation. Supervision may be fixed (because of idle supervisory capacity) in one department along all dimensions. In another, increase along any dimension may require adding an assistant foreman or a department clerk. Other departments may have capacity for increase along some dimensions but not along others. Some departments may be able to redistribute duties, *e.g.*, duties of working foremen, and so permit reasonably continuous variation along some dimensions. Electric power may, through the kilowatt-hour charge, vary continuously with increase in units of output in one department, while through the demand charge it varies irregularly with increase in capacity in the same or other departments.

In any event, each elemental burden account should be homogeneous; each dollar in the account should have the same meaning as each other dollar in the same account. The rule (or rules) of variation and the physical basis of the charge should be recorded in the heading of the account whenever possible. In some instances, it may prove desirable to keep the account in physical terms, as most perpetual inventories are kept. Dollars per unit may be shown in the heading if revisions do not occur too frequently.

These recommendations would tend vastly to increase the number of primary burden accounts kept in the factory ledger and to wipe out the secondary burden accounts altogether. The allocations and reallocations of traditional cost accounting would be relegated to

memorandums, where they could easily be varied to suit each problem as it arose and omitted altogether in the absence of specific managerial problems.

### *Conclusion*

Traditional cost data tend to be irrelevant and mischievous. These systems of simple proportional divisions followed by allocations and reallocations do not provide data appropriate for managerial use in planning or controlling operations. Moreover, they tend to put such data as do exist in an inaccessible form. Unless other purposes for such data exist, the systems should be discontinued to save the clerical costs of operating them.

For managerial planning, alternate programs should be formulated and regarded as the cost units or costing points. The physical requirements of each alternate program should be estimated with due regard to spans of anticipation. These physical requirements should be priced in terms of problem and situation, seeking a true evaluation of each rival program as an integral whole. Finally, with due regard to intangibles, the best program should be selected.

The use of alternate programs as cost units eliminates the doubtful allocations with which traditional cost accounting is saturated. With the program approach, either an expense (*i.e.*, a cash disbursement!) is incurred or it is not. In contrasting or comparing one program with another, cost and income items may be found common to both and omitted without study or estimate. Some items may belong to one program but not to another. Others may be of different amounts in rival programs. Here, instead of striving for an "equitable spreading of burden" or for an absolutely true single valuation, the program approach attempts to analyze physical differences between programs by items and the resultant changes in total receipts and disbursements associated with each proposed program. This approach allows analysis in terms of objective facts rather than subjective prejudices, notions, or ideas of equity and allows subsequent testing of at least the set of computations associated with the program selected. The traditional cost approach divides facts into "equitable" or "reasonable" fragments; assigns these pieces of costs to departments, products, processes, or jobs on an arbitrary basis; and provides no objective method of verification of the results found.

Once a purely factual basic record of details of operations is accumulated, analysis must wait on the emergence of a problem situa-

tion. This problem of managerial planning or control and its setting will provide the necessary background to enable

1. Discovery of the relevant dimensions of each cost element and the laws of its variation along these dimensions.
2. Discovery of a meaningful pattern of subtotals and totals.
3. Computation in terms of whole alternate programs, each conceived as a possible answer to a specific problem situation.

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- GRANT, E. L.: *Principles of Engineering Economy*, The Ronald Press Company, New York, 1938. Good treatment of sunk costs. Also considerable material and good bibliography on engineering cost estimating.
- HECKERT, J. B.: *Accounting Systems*, The Ronald Press Company, New York, 1936. An unusually fine job of keeping objectives in mind and of staying with an operational approach.
- LAWRENCE, W. B.: *Cost Accounting*, Prentice-Hall, Inc., New York, 1936.
- NEUNER, J. J. W.: *Cost Accounting*, Richard D. Irwin, Inc., Chicago, 1938. A good last chapter by W. J. Vatter on Reexamination of Cost Accounting from the Managerial Viewpoint. Vatter's approach seems to be: "Here are different kinds of costs. What can management do with each?" The inverse approach would seem better: "Here are managerial needs for cost data. How can these data be gathered?"
- SPECTHRIE, S. W.: *Industrial Accounting*, Prentice-Hall, Inc., New York, 1942. A good brief treatment of traditional burden allocation. Also a nibble at managerial uses of cost data in the last three chapters.
- VANSICKLE, C. L.: *Cost Accounting*, Harper & Brothers, New York, 1938.

There are a dozen or two more books on cost accounting. They all seem to present the same tradition with hardly enough variation to justify so many books.



## CHAPTER 7

### BASIC PECUNIARY RECORD

Purposes of chapter: to develop a satisfactory pecuniary record to serve as a basis for effective office procedures, meeting legal requirements, supplying information for other social groups, and providing management with data for planning and controlling enterprise operations; to explain accounting procedures and records in terms of their objectives; and to suggest a means of providing a record of facts containing a minimum of opinion.

Can a single record and procedure supply the pecuniary data needed for all the objectives discussed in Chapter 2? The classifications of data imposed by these several purposes are different. Effective office procedures require a classification sufficiently simple and objective to be used by ordinary grades of clerical help. Documents must be processed and records compiled with a minimum of error and a maximum of speed. Other social groups and law require a classification by periods, comparable among periods and as far as possible among enterprises. Managerial planning imposes a classification according to rival programs of action, flexible enough to facilitate reclassification as new possible programs emerge. Managerial control requires classification according to executive responsibility. A basic record, meeting all these diverse requirements, must utilize a set of classes that constitute a sort of "greatest common divisor." Each primary class should contain data that are homogeneous with respect to every dimension. If this desideratum of classification is achieved, the primary classes can be used as building blocks to construct any desired configuration of totals or indexes.

The valuations imposed by the several purposes served by accounting and cost data are also different. Effective office procedures require valuations that are simple, objective, and verifiable by disinterested auditors. The legal-financial requirements are similar but add a criterion of comparability. Evaluation of data for managerial planning is complex, running in terms of the dimensions and laws of change and complicated by varying spans of anticipation, the whole

shifting from problem to problem. Managerial control imposes an accounting valuation in terms of importance of items to management and ability of responsible subordinates to control such items. These requirements are antagonistic and cannot be reconciled in a single record. The basic record should be strictly historical and objective. Supplements can be designed to adjust values for the different purposes.

This chapter develops the theory of the basic record: a factual, objective recording of pecuniary history. The chapter analyzes the types and effects of elemental pecuniary operations. A method, essentially the traditional method, is worked out for recording these elemental pecuniary facts as they occur. However, certain omissions and errors in the conventional treatment are corrected, and a self-consistent accounting theory is developed that is amenable to the logic of economics and of management. Extreme flexibility in the recording and reporting process is sought to facilitate reclassification and re-evaluation of the basic data to serve each of the major objectives of accounting.

#### PECUNIARY OPERATIONS

##### *Contracts*

From an accounting and operational point of view, the interactions of an enterprise with its environment tend strongly to take contractual form. The making and executing of contracts are the units of action by which an enterprise conducts the bulk of its pecuniary relations with its environment. In the main, the pecuniary history of an enterprise consists of a record of the making and execution of contracts.

A contract is an exchange: of an act for an act, of an act for a promise, of a promise for an act, or of a promise for a promise. Thus, each contract has two aspects: an "in" aspect and an "out" aspect. The accountant has named the in aspect *debit* and the out aspect *credit*. From an algebraic point of view, they may be named *positive* and *negative*.

In modern pecuniary society, one side of each contract tends strongly to provide for the receipt or payment of cash. Enterprises buy and sell for cash or promises of cash and borrow, repay, receive, and disburse cash. The other side of the exchange typically provides for the performance or receipt of a service or for the conveyance of title or other rights to property—neither directly measurable in pecuniary terms. The accountant treats the amount of cash involved as the measure of both debit and credit.

### *Separable Executions*

The making of a contract may be separated from its execution. Each contract may be regarded as an exchange of promises—the execution of each promise being more or less immediate or remote. The “act” is the execution of the contract: the delivery of the services or goods promised. Promises, then, are present rights to future acts. Thus each contract, at the instant of its creation, is a present right to a future receipt of a valuable good or service *and* a present duty requiring a future delivery of a valuable good or service. “Cash” may be regarded as “undifferentiated purchasing power”—also a present right to future receipt of economic goods and services.

The promise given and the promise received are independently executed. Consequently, after a contract has created associated future ins and outs, it is permissible to divorce the debit and credit aspects of the contract and to treat each as an independent fact. The values received and yielded can be classified and similar values grouped without regard to the nature of the values originally associated therewith. If cash is frequently received, the debits may be grouped in the class *cash* without regard to the nature of the associated credits. If cash is frequently disbursed, the credits may be grouped in this same class *cash* without regard to the nature of the associated debits. Since debits are positive and credits negative, a balance of the group or account can be found by algebraic addition.

### *Classification*

The initial classification should be simple and objective so that ordinary grades of clerical employees can identify items as belonging to particular classes. Skillfully arranged procedures built upon specialized division of labor will facilitate accurate and expeditious identification. By reporting credit sales, for example, on a particular form that follows a set procedure performed by a specialized clerical force, recognition is reduced to an automatic basis and the need for executive attention is minimized.

As far as possible, the initial classifying entry should be in terms of whole items. Division and allocation involve either arbitrary rules or judgment and should be avoided. As problems and situations shift, the basis of division and allocation should change to conform to new needs. Such reclassification should be relegated to supplementary records and calculations. The initial classification should provide an objective, factual basis upon which all subsequent and supplementary reclassifications may be erected. For example, the initial record should

follow the terms of the wage contract, the rent contract, or the purchase contract—viewed as a unit; *e.g.*, a lease provides for occupancy of a definite area for a definite period in exchange for a definite sum, and it should be so recorded. An appropriate journal entry would be

Dr. Deferred Charge to Rent Expense.....	\$6,000
Cr. Rent Payable.....	\$6,000
To record a 10-year lease with payments of \$50 per month. <sup>1</sup>	

Arbitrary allocations of the total as between areas or as between periods should be relegated to supplementary records.

As far as possible, the primary classes should be homogeneous—each dollar entered in an account should have the same significance (respond in the same way to the same changes in conditions) as each other dollar entered in the same account. To comply with this criterion, contracts that are composites of *independent* items may properly be divided. For example, the typical purchase of industrial power involves separate charges for kilowatt-hours used, for the demand load, and for the peak load and a separate adjustment for the power factor. These four independent elements of a single purchase should be recorded in separate accounts. Similarly, when an employee is paid by the week for a standard number of hours with extra pay for overtime, the pay check becomes a composite of independent parts, which should be separated in the primary accounts. Notice that if the standard pay for the standard hours is a unit, it should not be divided in the primary accounts.

Finally the pecuniary history should be complete. Every contract entered upon should be recorded as of the date of agreement. Every executory act should be entered. This rule eliminates the customary omission of liabilities under leases or under sales commitments. Agreements tend to be reasonably clean-cut, although instances arise in which the pecuniary measure can be determined only at a later date. In such instances, the agreement may still be recorded, either with provisional amounts so designated or with the amounts left blank. Executory acts frequently present greater difficulty. Executory acts may extend over considerable periods instead of occurring at a definite time as agreements occur. Division of such continuing executions and allotment to shorter periods typically contain a large arbitrary element better excluded from the basic factual record of pecuniary

<sup>1</sup> This entry records the full liability assumed under a lease. Accountants customarily fail to disclose such liabilities, although failure to pay rent when due may result in suit, judgment, and receivership.

experiences. Such allocations should be relegated to supplementary records. When execution is complete, an entry can be made to the basic record without taint of judgment or opinion.

### *Journalizing*

Having constructed a primary classification of exchange values in which to record pecuniary operations as they occur, the accountant is ready to begin practicing his art. Each contract and each executory act are described by a "business paper," usually prepared as an integral part of the operation. These business papers provide a basis for "journalizing." Journalizing is the process of analyzing an operation to determine which classes are debited (positive, or inflowing) and which credited (negative, or outflowing). The "amount" is determined from the pecuniary aspect of the transaction and assigned to debit and credit alike. Amounts so determined for the entry recording the making of a contract are also applied to subsequent executions of the contractual promises.

A typical transaction, a sale on open account, can be journalized as follows:

Dr. Accounts Receivable.....	\$50
Cr. Sales Commitments.....	\$50

The debit to accounts receivable means that the enterprise has a present right to a future receipt (inflow) of \$50 cash. The credit to sales commitments means that the enterprise has a present duty requiring a future shipment of merchandise, for which the enterprise will receive \$50 cash.

When the promise received is executed, the following journal entry will be made:

Dr. Cash.....	\$50
Cr. Accounts Receivable.....	\$50

This records a trade of one future for another of the same sense (both positive). A present claim to the future receipt of as yet undesignated economic goods or services is obtained, and a present right to a future receipt of cash is given up.

When the promise given is executed, *i.e.*, when the merchandise sold is shipped, the following journal entry will be made:

Dr. Sales Commitments.....	\$50
Cr. Sales (Shipments).....	\$50

This records the transition of an outflow from future to past.<sup>2</sup> However, the shipment extinguishes both a liability (sales commitments) and an asset (inventory). This requires a second journal entry recording a transition from future to past:

Dr. Cost of Goods Sold.....	\$30
Cr. Inventory.....	\$30

This entry is valued from the pecuniary aspect of the purchase by which the inventory was originally acquired, *i.e.*, the cash originally paid for the merchandise when it was purchased.

A few contracts arrange for barter transactions. The analysis into given and received introduces no new difficulties. The assignment of a magnitude or value requires an estimate, since there is no pecuniary phase to such contracts. The estimate should be made by the best qualified employee, usually one of the management group. The accountant, private or public, is seldom in a position to question the value assigned. The most common barter transaction arises from the "trade-in" of old equipment when new is purchased. Fortunately, the "value" of the old tends to be small, and the difference between "book value" and "resale value" at the time of trade-in tends to be even smaller. The value assigned to the old equipment is of no great significance in itself—its significance derives from the necessity of assigning a value to the newly acquired equipment. After trade-in, the old belongs to the irretrievable past, and the valuation of the new is affected by the valuation of the old to a relatively small extent.

Most enterprises experience occasional, minor, nonbargaining pecuniary transactions.<sup>3</sup> These include gifts made and received, taxes, windfalls, discoveries, losses, and expirations, *e.g.*, patents. Values that flow out or are dissipated in nonbargaining transactions either are themselves pecuniary or are assigned values by reference to the pecuniary aspect of the bargaining transaction by which the values were initially acquired. Values received as a result of nonbargaining

<sup>2</sup> As a matter of convenience when shipment soon follows the sale, the debit and credit to "sales commitments" may be omitted—which is the usual accounting practice. As with purchase commitments, at the ends of periods the outstanding liabilities should be disclosed on the balance sheet. It is a prevalent error not to show such outstanding sales commitments, which may prove as embarrassing as any other liability.

<sup>3</sup> John R. Commons distinguished three types of transactions: (1) bargaining transactions (discussed above), (2) managerial transactions (physical and internal), (3) rationing transactions (the subject of this paragraph).

transactions may be cash or promises of cash or must be estimated, since there are no antecedent valuations to which to refer. These nonbargaining transactions may be fitted into the same debit and credit mechanism as bargaining transactions by supplying "net worth" or "propriatorship" or "surplus" as the other side of each such entry.

### HISTORICAL WEBS

#### *Cyclical Character*

Business transactions are of a circulatory character. Productive resources are acquired by bargaining transactions, divided and recombined to create products by managerial transactions, and the product sold by bargaining transactions. The cyclical process begins with a cash credit and ends with a cash debit. If the cash received at the end of the process exceeds that paid out at the beginning, the proprietary interest is increased by the difference. Such an increase in the cash available for distribution is the ultimate meaning of the term *profit*.

The term *expense* evidently derives from the expenditures of cash at the beginning of the cycle, although the names of the expense accounts refer to the values received: direct materials, direct labor, superintendence, power, etc. Similarly, the term *income* must refer to the cash received at the end of the cycle, although the names of the income accounts refer to the values flowing out: merchandise sold, professional services rendered. In the "cash basis" of accounting, the timing of income and expense is related to the time of cash receipt and disbursement, *i.e.*, to the time of execution of the pecuniary aspect of the buying and selling contracts.

In the "accrual basis" of accounting, incomes and expenses are assigned to the times of execution of the nonpecuniary aspects of the buying and selling contracts, with a further adjustment for certain items that are carried as inventories until dissipated. Where execution of the nonpecuniary aspects precedes the receipt or disbursement of cash, the accrual basis gives rise to a class of accrued receivables and payables: accounts receivable, accounts payable, and all other receivables and payables such as accrued interest receivable or accrued taxes payable. Where execution of the pecuniary aspect precedes the nonpecuniary, the accrual basis gives rise to a class of *deferred* items: prepaid insurance, deferred tuition income, etc.

Deferred expenses shade off into inventoried properties. Advertising Supplies on Hand, for example, is usually carried among the *pre-*

*paid expenses* on the plea that the amount so shown is really a deferred charge to advertising. From here it is a short step to viewing the fixed assets as prepaid expenses. Building and Machinery are, in effect, *prepaid depreciation*. The contract of acquisition has been executed on both sides, but the value received is a property—the present value of future services to be received—and the property is written off to expense as the future services are received.

*Cost accounting* is an attempt to carry the process one step further: to inventory all items received until the cycle is complete and shipment of finished product is made. Usually only “production expenses” are charged to work-in-process inventory accounts as direct materials, direct labor, or overhead, but the suggestion has been repeatedly made that all overhead, including selling and administrative, should be allocated to specific products. Apparently the chief obstacle to more frequent attempts to make such allocations has been the difficulty in finding a satisfactory basis for allocation.

If each cycle were separate and independent of all other cycles, allocation would be simple and definite. The difficulties and irrationalities arise from the interwoven character of the cycles. “Batches” of productive resources are acquired by purchase. Managerial transactions divide these batches and assign the fragments to different jobs and products. The physical fragments are changed in character and reassembled into new patterns to produce finished goods ready for sale. Chapter 6 demonstrated the difficulty of tracing the pecuniary consequences of these internal, physical, managerial transactions and the error and uselessness of the traditional cost accounting methods for so doing

### *Periodical Cut-offs*

From the accounting point of view, values do not enter the web at all until contracts have been made—until legal rights exist. While the web is continuous through time, it can be imagined cut as of some particular instant. Then the unexecuted elements of contracts, the cash on hand, the undissipated properties—in short, the present rights to future receipt of services and present duties to render future services—are assets and liabilities and equities. These present aspects of future service flows are classified as “real” and exhibited on the balance sheet. The expired rights and performed duties are past or “nominal” and are shown on the “statement of income and expense.” From any one cycle, only two elements are shown as “past”:



the initial value acquired (shown as an "expense") and the final value traded for cash (shown as an "income").

In the accrual (almost the universal) system, the webs are cut into arbitrary lengths, usually one year. The recording process, at the end of any such period, has accumulated a record of contracts made and executory acts wholly performed. Adjustments are made for partial executions and for partial dissipations of asset items. After adjustment, no account will be "mixed"; i.e., no account will contain both future and past items. The division will be complete, and each account can be assigned wholly to the "real" balance sheet or to the "nominal" income statement.

### *Summary of the Operational Approach*

The operational approach regards the primary accounting record as a record of pecuniary transactions. Four general types of pecuniary transactions are recognized:

1. Contracts are negotiated: promises are exchanged with other economic units.

2. Contracts are executed: promises are redeemed by performance.

3. Property rights gradually expire. Some contracts are executed by delivery of rights to property, and many of these rights are gradually dissipated by lapse of time or by wear and tear.

4. A relatively few noncontractual transactions occur, e.g., taxes, gifts, losses, proprietary investments, and withdrawals.

All such transactions have two aspects: an inflow and an outflow of value, called *debit* and *credit*, respectively. Once the transaction has occurred, the two aspects become independent, and each can be separately classified. Managers and others are interested in five aspects of each value flow:

1. The time of occurrence, shown by a date.

2. The cause of occurrence, shown by an account title, which also provides for subsequent grouping with other similar events.

3. The pecuniary magnitude involved, shown by a figure determined by the pecuniary side of the contract. Executions are valued by reference to the pecuniary side of the contract creating the promise executed. Estimates are used reluctantly where no historical figure exists, e.g., barter transactions and noncontractual receipt of non-pecuniary goods or services.

4. Whether the flow is in or out, shown by classifying the item as debit or credit.

5. Whether the item is past or future, shown by classifying the item as *nominal* or *real*.

The double dichotomy of debit and credit and real and nominal divides all accounting data into four classes:

1. Future ins. Present rights to future receipts of cash, goods, or services are called *assets*.

2. Future outs. Present commitments to future disbursements of cash, deliveries of goods, or rendering of services are called *equities*. If definite amounts at definite dates are involved, the equity is called a *liability*. If dates and amounts are indefinite, the equity is called *proprietorship* or *net worth*. Liabilities and net worth are not so sharply distinguishable as debits and credits or as real and nominal. They shade into each other by degrees.

3. Past ins. When the services promised by an asset have been received (dissipated, or past), they become *expenses*.

4. Past outs. When commitments to deliver goods or services have been fulfilled, the liability becomes an *income*. The word *income* is unfortunately chosen, but its true nature can be seen by considering the names of the income accounts: professional services rendered (a past performance or outgiving of services), merchandise shipments (usually abbreviated to *sales*).

The making and executing of contracts are usually accompanied by documentary evidence. Pecuniary transactions not so accompanied are referred to responsible executives in the accounting department, who prepare such documents. These documents, or "original evidences," enter the bookkeeping procedure. They are sorted and sent to specialized journal clerks. These employees prepare "journal entries"—analyses of transactions according to the accounts affected, which debited and which credited, the amounts involved, and an explanation if needed. Later, the journal entries are posted, either item by item or as totals accumulated in the journals, to the ledgers. This is merely a sorting process to get like items together.

Here ends the basic pecuniary record. The adjustments for partially executed contracts and partially expired rights and obligations should be relegated to a *legal-financial supplement*.<sup>4</sup> They tend to be arbitrary or to involve judgments better excluded from a record that attempts to report financial history objectively. As executions become complete, the judgment element disappears and the record can be transferred from the legal-financial supplement to the basic record.

<sup>4</sup> See pp. 161-162.

AN ANALYTICAL APPROACH<sup>5</sup>

The description of the accounting process (essentially the traditional process) can also be approached analytically. Either approach describes the same system, functioning in the same way and producing identical results. The operational approach begins with the transaction, proceeds through various classifying and summarizing operations, and ends with the reports to managers and other interested parties. The analytical approach begins with the enterprise, analyzes it in terms of the information desired, and continues the analyzing process to journalizing, which is regarded as the first chronological step—analyzing transactions into the lowest terms of the analytical hierarchy.

*The Accounting Equation*

The enterprise is viewed, for accounting purposes, as a collection of values. If the aggregate is analyzed into classes according to the properties exhibited by the carriers of the values, a list of "assets" results. If the aggregate is analyzed into classes corresponding to the legal claims of other economic units, a list of "equities" results. Thus, the "balance sheet equation," assets = equities, is a statement of identity.

The equities may be divided into two classes: "liabilities" and "net worth." The net worth, in turn, may be divided into parts: one part for each class of stock issued (all valued at par) and "surplus." Surplus may be further divided into the part arising from operations of the current accounting period and all other surplus. Finally, surplus arising from current operations (profits) is equal to income minus expense. At the end of each period, the profit account will be closed into one of the surplus accounts, clearing the profit account to prepare it for the accumulation of income and expense data for the ensuing period. The analysis may be put in the form of an equation (the equation of the general ledger) as follows:

$$+ \text{assets} - \text{liabilities} - \text{capital stock} - \text{surplus} - \text{income} + \text{expense} = 0$$

Now a completely consistent theory of debit and credit is achieved by identifying "debit" with "positive" and "credit" with "negative." The signs attached to the terms of the equation show the normal status of account balances. Since the equation is a combination of identities

<sup>5</sup> To some degree this is an extension of Paton's treatment in *Accounting Theory*, Chap. 2, The Ronald Press Company, New York, 1922.

and definitions, it is still an identity, and must always be true (for business enterprises).

It follows that at any moment or in any one transaction, the sum of positives and negatives must equal zero: the debits must equal the credits.<sup>6</sup>

### *Importance of the Major Classes*

Assuming that the accounting records exhibit current conditions with reasonable accuracy (which is too much to assume), the four major classes (assets, liabilities, incomes, and expenses) present data of great significance to management and to each of the pressure groups management is attempting to placate. Income minus expense equals profits, a measure of the enterprise's ability to satisfy the pressures brought to bear. Assets minus liabilities equals owners' equity, of obvious direct interest to owners and a measure of the cushion protecting creditors from loss.

These absolutes cannot have the significance attaching to ratios. "Profits" as a number of dollars is not so significant as "profits" stated as a return on investment. Here is a measure recognized in finance and in economics as an indication of the success of the enterprise from the point of view of the owners. A satisfactory rate of return on investment is the best single guarantee against insolvency and loss to creditors. All four of the major classes combine to yield this significant ratio:

$$\frac{\text{Income minus expense}}{\text{Assets minus liabilities}}$$

The ratio of net profit to total income is an indication of operating risk. It is a measure more of uncertainty than of danger, except as danger arises in uncertainty. If the ratio is small, minor percentage changes in expenses will result in large changes in the rate of return on investment. If the change is adverse, the large losses resulting may threaten the safety of creditors, whereas a favorable change results in large profits to stockholders. On the other hand, where the ratio is large, perhaps approaching unity as in some personal service establishments, the operating risk tends to be small. Large percentage

<sup>6</sup> This view of debit and credit is not discussed by Paton, *ibid.*, in his chapter on Debit and Credit, Chap. 10, and does not appear vulnerable to the criticisms of other views there presented. Nor does it appear quite so arbitrary as Paton's conclusion of "left-hand" and "right-hand."

changes in expenses are not likely to threaten the financial stability of the enterprise.

The ratio of net worth to total assets is another indication of risk—of the probability of loss to creditors in the event of liquidation. If this ratio is small, it is a definite indication of danger to creditors. If the ratio is large, the creditors are protected by a large factor of safety; assets must shrink excessively before the stockholders' equity is eliminated and the creditors begin to lose.

The ratio of total income to total assets is a rough indication of the degree to which the enterprise's capacity is being utilized. The ratio of total income to selected portions of total assets gives an idea of the utilization of various classes of properties, perhaps most significantly of fixed assets and of inventories.

The ratios of cash, of quick assets, of current assets to total assets are indexes of flexibility. The larger the proportion of enterprise assets in uncommitted pecuniary form, the greater the flexibility and the easier to make fundamental changes in policies with a minimum of conversion losses.

The significance of all of these ratios is enhanced by reporting them as trends. Comparison of accounting figures or ratios with corresponding data of past periods reduces the distortion produced by arbitrary conventions in classifying or evaluating the data. Furthermore, even the ratios carry an absolutist flavor reduced by the use of trends. Instead of an attempt being made to measure flexibility, for example, by means of a ratio, the direction of change of flexibility is shown by the trend. Thus, if quick assets are becoming a progressively larger proportion of total assets, it is reasonably safe to conclude that flexibility is increasing. If the ratio of gross income to inventories is increasing, the investment in inventories is being more fully utilized. This is not necessarily a good thing. It may indicate approaching inadequacy—insufficient selection and slow deliveries alienating customer good will or impending shutdowns of factory departments for lack of materials. In general, one would expect optimum values with dangers of different kinds attending deviations from the optimum in each direction. Of course, the optimum values would change with changes in plans or in conditions. Finally, any total or ratio or trend is likely to be a conglomerate of elements, some favorable and some adverse.

The longer the period covered by a trend, the more likely the occurrence of significant changes in price levels. This may necessitate

complete adjustment of accounting data for such changes.<sup>7</sup> The necessity depends upon the purpose for which the data are to be used and upon the extent of the changes that have taken place in prices. The adjustments would never be made in the basic pecuniary record but would be relegated to special-purpose supplements.

#### FLEXIBILITY OF RECORDS

##### *Need for Flexibility*

Different purposes require different classifications and evaluations of data. The basic pecuniary record makes provision for reclassifications and reevaluations. Each of its primary accounts or classes of data contains homogeneous data—items following the same laws of change with respect to every dimension that may prove important to management. These items each represent a whole transaction or occasionally a wholly independent part of a transaction. By maintaining a relatively large number of small accounts, each internally homogeneous, any larger classes for any particular purpose can be easily constructed. The original record remains unaffected by such subsequent groupings and consequently is available as a basis for any other classifications that may prove desirable for other purposes.

On the valuation side, the basic pecuniary record provides a firm basis for subsequent reevaluations. It simply records whatever happened. The figures are straight pecuniary history, completely unadjusted. Estimate enters only where the original transaction was nonpecuniary. Estimates then attempt to approximate market valuations, *e.g.*, in barter transactions and in nonpecuniary, noncontractual receipts of values. The whole object of the basic pecuniary record is to provide a "neutral" record of historical incidents in the interchange of values between the enterprise and its environment.

Certain classifications and evaluations are recurrent because certain needs for data are repetitive. The law requires submission of certain reports containing fixed classifications and evaluations of data—sometimes merely requiring that the same classifications and methods of evaluation be used repeatedly. Examples are the requirements imposed by the income tax regulations, the Securities Exchange Commission, rate regulatory commissions, and war contract negotiations. Other social contacts may also impose a requirement

<sup>7</sup> See Sweeney, *Stabilized Accounting*, Harper & Brothers, New York, 1936.

of comparability<sup>s</sup> in classification and evaluation, both among time periods and among enterprises, *e.g.*, credit agencies. This requirement is often implemented by requiring statements certified by independent public accountants.

Reports used as a basis for managerial control of operations also follow a standard configuration both as to classification and as to evaluation. It happens to differ from the configuration needed for social contacts but is just as persistent. The structure of the operating organization exhibits considerable stability, and this structure imposes the classification of data for control. Evaluation runs in terms of the importance of each item to management and of the amenability of each item to control. The historical valuation is one factor to be considered in estimating the importance of each item to management. However, this valuation may be adjusted for changes in price levels or because the original cost has become sunk and therefore irrelevant, and always it must be modified in accordance with the ability of the subordinate to control it.

A very few problems of managerial planning are recurrent to the point of suggesting standard patterns of classification and evaluation. Some pricing problems may be recurrent and may require a standard content in the data considered. Even in these instances, the valuations desired are likely to be current market or, less frequently, current resale values. Where a line consists of many patterns, certain standard configurations of data may aid in deciding when to replace patterns of declining popularity with new styles.

### *Obtaining Flexibility*

The variety of requirements places a premium on flexibility. Modern accounting systems provide elements of flexibility at each stage of the processing of records. Managerial accounting would deliberately harness these aspects of flexibility to the task of providing all the variety of data needed by management. One such element of flexibility originates in the preparation and filing of the original business papers. These may be prepared in multiple copies, and the copies filed according to a number of independent systems of classification. Many of the desired subtotals may be found by running adding machine tapes from the appropriate files of original evidences. Even the valuations appearing on different copies may not be identical;

<sup>s</sup> Only more or less achieved, usually more as among successive periods and less as among enterprises.

*e.g.*, one copy may carry the sales price, another the "cost" as found by a traditional cost system.

A second device for providing a variety of classifications of data is the use of registers and journals provided with special classifying columns. By entering each business paper in such books of original entry, the items may be spread among the columns and the columns later footed to supply any desired standard hierarchy of subtotals and totals.

A third device provides subsidiary ledgers and control accounts to accumulate significant totals. The primary accounts will be those constituting the lowest level of subsidiary ledgers. These can be piled up into successive levels of control accounts. Factory expenses may be classified in a factory ledger and "controlled" by a Factory Expense Control account in a general ledger of a branch or a subsidiary, which, in turn, is controlled by a Branch account on the general ledger of the home office. This device has been much abused by traditional cost accounting. The primary accounts in the factory ledger are broken up and prorated among departmental expense accounts. The service department accounts are reallocated among the processing department accounts, and these are closed by allocation to the job cost sheets. Such classification and reclassification should be directed at specific managerial objectives, should reflect the actual economic or engineering behavior of the items involved, and should never destroy the availability of the primary data.

Finally, the need for a variety of classifications and particularly the need for classifications not contemplated specifically at the time of original entry suggest the use of punched cards and mechanical tabulating and summarizing equipment. If each transaction or each independent aspect of a transaction, *e.g.*, each item appearing on a sales invoice, is punched into a separate card, and if each card bears a complete record of the transaction, the original record is maintained in a highly accessible form. Duplicate cards can be punched for filing in various classifications. Any given file can be quickly and economically reclassified according to any desired pattern as long as the information has been punched into the cards. Subtotals can be preserved by the automatic punching of summary cards. New valuations can be introduced by automatic duplication of the unchanged portions of old cards, manual punching of the new values, with automatic punching of extensions. The cards are sorted and tabulated, and a printed report prepared—all mechanically, accurately, rapidly, and economically.



*Price-level Adjustments*

Punched card accounting offers an opportunity for complete adjustment for price-level changes.<sup>9</sup> As each card is punched, the historical value may be punched into the card, automatically divided by the price index, and the valuation in terms of the value of money in the base year also punched into the card. Thus, management can obtain historical data or data completely adjusted to a standard price level, whichever are desired. When adjusted data are desired expressed in terms of current price levels, the data adjusted to the base period may be automatically multiplied by the prevailing index. Finally, such adjustments may be completely objective in the sense that fixed procedures are followed, with opinion and judgment excluded. That is, data adjusted for price-level changes are as objective and as subject to independent verification by third parties as historical data.<sup>10</sup>

*Note on the legal-financial supplement.*<sup>11</sup> The outstanding requirements imposed by the legal-financial objectives of accounting are objectivity and comparability. In the main, these are secured by the use of historical valuations and by the adoption of a reasonably standardized classification of accounts. The historical valuations are provided more consistently by the proposed basic pecuniary record than now obtains in practice, where many companies make at least some use of appraisal values. The basic pecuniary record also provides ample basis for the preparation of a balance sheet exhibiting a classification of data according to the "currentness" of items, *i.e.*, the nearness of the item to the final conversion to cash in the ordinary course of operations. The income statement can also be prepared from the classification of the basic pecuniary record in any of the forms recommended by texts or by financial institutions.

The need for a supplement arises in the chopping up of the stream of transactions into a series of discrete periods. To maintain the highest degree of comparability between periods, the accountant insists

<sup>9</sup> Carrying Sweeney's argument to its ultimate conclusion.

<sup>10</sup> Economists and statisticians have long recognized the need for price-level adjustments. Sweeney, MacNeal, and some German accountants have been almost the only accountants to recognize this need. However, very recently a number of firms have modified their depreciation, fund, and reserve practices to take into account higher replacement costs of plant and equipment.

<sup>11</sup> This note replaces a chapter originally contemplated on the Legal-financial Supplement. However, much of the material intended for the chapter has fitted in other places; and being nonmanagerial, the discussion is a digression intended only to safeguard the other objectives of accounting (see Chap. 2).

upon adjusting the data to an "accrual" basis—upon prorating partially executed promises between time periods. The theory of adjusting for accrued and deferred items was discussed some pages back. Here it is proposed that such adjustments be relegated to a supplemental record. By combination of such a supplemental record and the basic pecuniary record, the traditional financial statements can be prepared without tampering with the degree of objective, historical validity attained in the basic record. The "adjusting entries" should be made in a special journal and posted to the supplementary ledger. The basic record and the supplementary ledgers' trial balances can be consolidated on a work sheet much as the financial statements of affiliated enterprises are consolidated.

#### MANAGERIAL IMPLICATIONS

##### *The Profits Test*

The basic pecuniary record has important managerial implications. It provides many of the data needed to judge the over-all success of the enterprise. Merged with the legal-financial supplement, the basic pecuniary record provides the statement of profit and loss. In a general and comprehensive way, the statement of profit and loss shows if managerial judgment in selecting from among rival plans has proved sound. It gives a strong indication of the survival value of the enterprise and shows how far management can go in further satisfying the demands of the pressure groups: customers, employees, owners, suppliers, and community.

The basic pecuniary record plus the legal-financial supplement also produce the balance sheet. As noted earlier in the chapter, the absolute size of profits is not an adequate test of success. Their size relative to investment is much more significant. The balance sheet tells something of the size and character of the investment. Both statements are needed to gain a general over-all picture of the success of management and of the enterprise.

Historical data are open to various objections. Price levels change. Both statements carry loads of estimates introduced through the adjustments of the legal-financial supplement. Fortuitous circumstances and technological change render historical valuations obsolete and inaccurate. Both balance sheet and statement of profit and loss are much more useful if both historical values and values adjusted for changing price levels are shown. This meets the price-level objection. If comparative statements are prepared and attention focused on

trends rather than on present magnitudes, many of the other distortions cancel out by influencing successive years in approximately equal degree.

### *A Pattern for Managerial Choice*

Since performance will be judged in part in terms of balance sheet and statement of profit and loss, plans will be judged in part in terms of the anticipated effects on future balance sheets and statements of profit and loss. Indeed, a complete budget for a program of future conduct ends with estimated financial statements. Rival programs are completely budgeted, and the resulting estimated financial statements compared as an important factor in selecting the most desirable program.

This factor, though important, must not be overweighted. Data from market analyses; managerial judgments concerning the effects of anticipated changes in technology, demand, and institutional environment; and the factors considered in the next two chapters must be taken into account. Conceivably all such factors could be reflected in estimated financial statements running far into the future, in which event the whole problem of selecting the most desirable of rival programs would be reduced to a comparison of alternate sets of estimated balance sheets and statements of profit and loss. Usually such full reflection of intangibles proves baffling, and more direct (intuitive?) judgments are made.

### *Managerial Representation*

Management also conducts the major social contacts of the enterprise. Balance sheets and statements of profit and loss are in wide demand by stockholders, creditors, employees, customers, and governments. Property and income taxes are based on the financial statements. Unions are demanding such data as relevant to negotiations looking toward revision of wage rates. Credit analysis is largely based on the financial statements.

History though it may be, data from the basic pecuniary record have been rightfully accorded an important place in managerial thinking.

### RELATED READING

*Accounting Review*, American Accounting Association, January, 1942. This issue contains a "Tentative Statement of Principles" issued by the association together with a number of articles discussing various principles. The entire tone is traditional and confined to legal-financial aspects to the complete exclusion of managerial problems and needs for data.

- GILMAN, S.: *Analyzing Financial Statements*, The Ronald Press Company, New York, 1934. Gilman discusses a great many ratios, their meanings and limitations. Especially as to limitations and qualifications, Gilman's second edition is vastly superior to the first and to Bliss's *Financial and Operating Ratios*.
- MAY, G. O.: *Twenty-Five Years of Accounting Responsibility*, American Institute, 1936. May presents one of the most lucid, rational, and powerful defenses of the tradition. However, his entire presentation is oriented to legal-financial aspects of accounting. He almost ignores the concept of accounting as a tool of management.
- PATON, W. A.: *Accounting Theory*, The Ronald Press Company, New York, 1922, contains a fine analysis of the accounting concept of income, a presentation (without much analysis) of accounting postulates, and a devastating criticism of a number of concepts of debit and credit (without supplying a useful alternative). Paton gives an excellent presentation of the balance-sheet approach to double-entry theory.
- SWEENEY, H. W.: *Stabilized Accounting*, Harper & Brothers, New York, 1936. Sweeney presents an unanswerable case for price-level adjustments. The arguments against such adjustments do not meet the issues he raises. In general, they argue in terms of accounting for accountants, whereas Sweeney argues in terms of accounting for use.

## CHAPTER 8

### TECHNIQUES OF MANAGERIAL PLANNING

Purposes of the chapter: to analyze the processes of managerial choice: how managements discover planning problems, how alternatives are described and compared, and finally, the need for review and reconsideration.

Chapter 4 demonstrated the nature, variety, and importance of problems of managerial planning. A varied but by no means exhaustive group of illustrations served to bring out the characteristic flavor of such problems. All are problems of choice. All can be stated in the form, "Which is preferable, Plan A or Plan B?" All pertain exclusively to the future, as the past is unalterable and consequently no longer a managerial problem. The present chapter analyzes the technique employed by managements in approaching these varied and important problems of planning.

Chapter 5 analyzed the physical standards used as building blocks in the construction of managerial plans. Chapter 6 described the difficulties and methods of determining the financial implications of physical components of managerial plans. Chapter 7 discussed the profits test and the pattern for appraising management's success in past operations. This pattern is also used as a basis for integrating estimated financial implications of detailed plans into budgets predicting the degree of future success of the enterprise. The present chapter fits these concepts into a systematic approach to the type of problems outlined in Chapter 4. Chapter 9 applies this analysis to three fairly elaborate illustrations of the theory and technique of managerial planning.

The analysis of this chapter is divided into the following more or less chronological stages of the processes of managerial planning:

1. Finding attractive alternate courses of action
2. Developing the details of alternate plans
3. Reducing plans to comparable bases
4. Testing selected plans: reconsideration and review

## FINDING ALTERNATIVES

*Technique of Discovering Problems*

First, and perhaps most difficult, is the recognition of the existence of a problem: that an unsatisfactory condition exists, that improvements are needed, that better alternatives must be sought. Some few problems force themselves upon the attention of management as when a sudden shortage of materials or labor threatens a shutdown or a landlord serves an eviction notice. Union demands, new laws, an acute shortage of working capital generally make themselves sufficiently conspicuous to start management diligently seeking a solution. Almost as obvious problems go unrecognized by managements habituated to customary methods of operating, slowly made obsolete by a changing society. Many plants have grown slowly through the years, adding a building here and a lean-to there, covering spaces between buildings, adding floors or balconies to existing structures. Such plants typically are full of bottlenecks and traffic jams. Differing floor levels and a multiplicity of walls interrupt the flow of materials. To an outsider, such a plant resembles a rabbit warren and shrieks for cleaning out obstructions and simplifying materials handling. Yet the resident managers, who have added the obstructions one at a time, have become accustomed to each in turn and are altogether unaware of major layout problems.

One method of discovering problems, of staying out of a rut, is contact with the outside: through reading, through visiting other enterprises, through interchange of experiences at association meetings, through occasional "bringing in of new blood" to fill vacancies in the enterprise organization, or through employment of consultants. Any of these contacts may suggest the desirability of adopting a new plan of job evaluation, new materials or processes, an extension of plant work simplification techniques to office activities, or the conveyerizing of production and assembly lines. There is scarcely a managerial problem that cannot conceivably come to light through such contacts. Managements certainly should put themselves in the path of such discoveries.

A less haphazard approach to discovery of planning problems is the "exception principle" in management. This device takes several forms. Time series of great variety are studied for trends, changes, or "exceptions." Comparative balance sheets and statements of profit and loss are prepared; data showing costs of successive manufacturing

lots are gathered; repeated statistical analyses are made of the pattern of the enterprise's markets. All these and more are studied to discover significant changes that management must plan to meet. Often managerial imagination can be stimulated by carrying such data back over a period including at least one major peak and one major trough of the business cycle. This gives a better historical perspective, an idea of how high peaks can be, of how low a trough is possible, and of how rapidly the transition may take place. On the basis of such data, budgets can be prepared showing managerial expectations. Later, actual performance can be compared with such budgets and significant deviations singled out for further study. The deviation, the unexpected, the unforeseen, is the exception that reveals or discovers problems to management.

Another device for discovering planning problems is the use of a check list. Blindness to major problems through overemphasis of detail is avoided by organizing such a list into a comprehensive outline, in which details are subordinated to and grouped around major issues. Many good texts in management or in any major field of management supply such outlines of major problems, analyzed into subproblems, divided in turn into significant factors influencing managerial decisions.<sup>1</sup>

### *The Periodical Management Audit*

Much the most comprehensive and powerful of these problem-seeking techniques is the periodical management audit. Just as a conventional audit seeks to discover and correct bookkeeping errors, so a management audit seeks to discover and correct errors of management. James O. McKinsey advocated such a periodical management audit, guided by such an outline and utilizing every device for discovering and solving managerial problems. The major headings of such an outline may run something like this:

1. Outlook for the industry
2. Position of the company in the industry
3. Policies
4. Organization

<sup>1</sup>One of the most comprehensive and most useful as a basis for periodical management audits forms the structure for W. H. Newman's *Business Policies and Management*, South-Western Publishing Company, Cincinnati, 1947. An earlier and somewhat modified version of J. O. McKinsey's outline for a general survey of a business enterprise appears in the *Monthly Bulletin of Robert Morris Associates*, Vol. 14, No. 9, February, 1932.

5. Personnel
6. Methods and procedures
7. Facilities
8. Financial position and forecast

*Outlook for the industry.* Investigation of recent trends in the industry and of the prospects of major customer industries may reveal fundamental problems, e.g., approaching saturation of a market with dropping off of sales volumes to stabilized replacement levels, obsolescence of a product tending toward gradual complete disappearance, or appearance of a plethora of new applications promising rapid expansion. Thus, the gradual westward shifting of the center of population and of manufacturing has continuously changed the relative geographic advantages of competing steel mills. Increasing numbers of airports should continually expand markets for manufacturers of airplanes and auxiliary equipment, just as an expanding network of good roads increased the demand for automobiles. The rising cost of lumber, together with falling costs of light metals and the appearance of many new plastics, has resulted in redesign of many products and a corresponding shift of resources from industry to industry.<sup>2</sup>

*Position of the company.* Comparison of company volume, price, and profit data with totals or averages for the industry and with major competitors may reveal significant changes or trends.<sup>3</sup> Thus a manufacturer of piano benches became alarmed at a reduction of 40 per cent in volume between 1929 and 1934. Investigation showed that this alarm was too little and too late. Piano sales had turned downward in 1923 and had fallen to approximately 8 per cent of the

<sup>2</sup> A great deal of statistical data are published by trade associations and in trade journals; see December and January issues of *Steel*, *Iron Age*, and *Electrical Merchandising* for excellent examples of the kind and quality of data sometimes available from such sources. The great bulk of published statistical data comes from government sources, e.g., *Survey of Current Business*, United States Census, *Statistical Abstract*. Excellent descriptions of such sources of data are given in Hauser and Leonard, *Government Statistics for Business Uses*, John Wiley & Sons, Inc., New York, 1946. There are also important private sources such as Moody's, *Standard Statistics*, and F. W. Dodge.

<sup>3</sup> An enterprise's accounting records should so classify data, especially as regards sales volumes, as to facilitate comparison of company data with industry or competitive data. If a number of customer groups are served, company sales data should be classified to enable comparison with volume data of each such customer group.



1923 volume by 1934. This basic trend had been obscured by failures of competitors, allowing this one enterprise to maintain its volume at a relatively high level.

Field studies may reveal consumer, retailer, and wholesaler opinions about the enterprise and its competitors. What are their comparative reputations for quality, reliability, fair treatment, prompt deliveries, service, adjustment of complaints, etc.? How effective is the enterprise's sales promotional activities as compared with its competitors? Are salesmen competent, well trained, and cooperative? Are product designs in style, durable, economical, and effective? Comparative engineering tests, which should also be made, will reveal actual differences, but only field studies can reveal the beliefs of buyers—which may be much more important.<sup>4</sup>

Study of the position of the company in the industry should enable forecast of the company's future by superimposing these data on the industry trends already established. If an enterprise has been growing more rapidly than an expanding industry in which it operates, and if the basic conditions continue to favor expansion of the industry and the growing position of the enterprise in the industry, the prospects of the company are bright indeed.

*Policies.* Policies may be systematically passed in review by following an outline such as that given in Chapter 4. This pattern can be developed in greater detail by supplementing it from the outlines of textbooks on sales management, production management, purchasing, personnel, and financial management.<sup>5</sup> Such texts attempt to

<sup>4</sup> The technique of making such field studies is elaborated in

Brown, *Market Research*, The Ronald Press Company, New York, 1937.

F. C. Wheeler et al., *The Technique of Marketing Research*, McGraw-Hill Book Company, Inc., New York, 1937.

H. W. Hepner, *Effective Advertising*, McGraw-Hill Book Company, Inc., New York, 1941.

<sup>5</sup> For finding lists of problems of sales policy, see

W. H. Newman, *Business Policies and Management*, South-Western Publishing Company, Cincinnati, 1940.

H. R. Tosdal, *Introduction to Sales Management*, McGraw-Hill Book Company, Inc., New York, 1940.

P. D. Converse, *Selling Policies*, Prentice-Hall, Inc., New York, 1927.

A. W. Frey, *Manufacturers' Product, Package and Price Policies*, The Ronald Press Company, New York, 1940.

B. R. Canfield, *Sales Administration Principles and Problems*, Prentice-Hall, Inc., New York, 1941.

(Footnote continued on following page)

discuss the problems met by managers in their respective fields, and their outlines call the rolls of such problems.

Which of all these possible problems are really problems of a particular enterprise? How can a management tell what needs attention, where to employ the machinery of managerial planning? The investigation of outlook for industry and company may have revealed weak spots. Calling the roll of policies may have revealed inconsistencies. The exception principle may be applied to deter-

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Alexander, Surface, Elder, and Alderson, *Marketing*, Ginn & Company, Boston, 1944.

Phillips, *Marketing by Manufacturers*, Richard D. Irwin, Inc., Chicago, 1946.

For finding lists of problems of manufacturing policy, see

W. N. Mitchell, *Organization and Management of Production*, McGraw-Hill Book Company, Inc., New York, 1939.

Lansburgh and Spriegel, *Industrial Management*, John Wiley & Sons, Inc., New York, 1940.

Knowles and Thomson, *Industrial Management*, The Macmillan Company, New York, 1945.

R. C. Davis, *Industrial Organization and Management*, Harper & Brothers, New York, 1940.

For finding lists of problems of purchasing policy, see

W. N. Mitchell, *Purchasing*, The Ronald Press Company, New York, 1927.

H. T. Lewis, *Industrial Purchasing*, Business Publications, Inc., Chicago, 1940.

For finding lists of problems of personnel policy, see

Scott, Clothier, Mathewson, and Spriegel, *Personnel Management*, McGraw-Hill Book Company, Inc., New York, 1941.

D. Yoder, *Personnel Management and Industrial Relations*, Prentice-Hall, Inc., New York, 1946.

J. E. Walters, *Personnel Relations*, The Ronald Press Company, New York, 1945.

For finding lists of problems of financial policy, see

A. S. Dewing, *Financial Policy of Corporations*, The Ronald Press Company, New York, 1934.

C. W. Gerstenberg, *Financial Organization and Management of Business*, Prentice-Hall, Inc., New York, 1939.

The literature of controllership is not as well organized, but for help on controllers' problems of policy, see

G. O. May, *Financial Accounting*, The Macmillan Company, New York, 1946.

R. M. Montgomery, *Theory and Practice of Auditing*, The Ronald Press Company, New York, 1940.

W. A. Paton, *Accounting Theory*, The Ronald Press Company, New York, 1922.

Paton and Littleton, *Corporation Accounting*, American Accounting Association, 1940.

J. B. Canning, *Economics of Accountancy*, The Ronald Press Company, New York, 1929.

W. H. Leffingwell and E. M. Robinson, *A Textbook of Office Management*, McGraw-Hill Book Company, Inc., New York, 1943.

H. L. Wylie, *Office Management*, Prentice-Hall, Inc., New York, 1937.

mine which are pertinent. For example, investigation of accounting data may reveal trends with respect to volumes by product lines, by types of customers, or by territories, suggesting abandonment of some fields and more intensive cultivation of others. Similar studies of purchase records may reveal unreliable sources, uneconomic purchase lots, or marked differences in prices, quality, or discounts among available sources.

*Organization, methods and procedures, facilities, finance.* Similarly, the discussion of the range of organizational problems in Chapter 4 may be used as a check list, amplified by detail gleaned from the excellent literature on the subject.<sup>6</sup> Operations may be analyzed by simo-charts to discover unnecessary motions or poor sequences. Procedures can be charted in a search for duplications and unnecessary steps. The flow of material through a shop or of documents through an office can be mapped on a drawing showing layout of buildings and locations of machinery, desks, and equipment. This may reveal back-tracking, congestion, need for material-handling devices, or poor locations of stock rooms, washrooms, etc.<sup>7</sup> Investigation of trends revealed by comparative balance sheets and operating statements may disclose incipient financial troubles long before they become insoluble.<sup>8</sup>

<sup>6</sup> See especially

Holden, Fish, and Smith, *Top Management Organization and Control*, Stanford University Press, Stanford University, Calif., 1941.

Gulick and Urwick, *Papers on the Science of Administration*, Institute of Public Administration, 1937.

R. Robb, *Lectures on Organization*, Harvard University Press, Cambridge, Mass., 1910.

H. S. Dennison, *Organization Engineering*, McGraw-Hill Book Company, Inc., New York, 1931.

C. Barnard, *Functions of the Executive*, Harvard University Press, Cambridge, Mass., 1942.

Mooney and Reiley, *Principles of Organization*, Harper & Brothers, New York, 1939.

<sup>7</sup> See literature on motion study and operation analysis, especially

R. Barnes, *Motion and Time Study*, John Wiley & Sons, Inc., New York, 1940.

A. H. Mogenson, *Common Sense Applied to Motion and Time Study*, McGraw-Hill Book Company, Inc., New York, 1932.

Maynard and Stegemerten, *Operation Analysis*, McGraw-Hill Book Company, Inc., New York, 1939.

<sup>8</sup> This literature is not in good shape. Ratios or trends of ratios computed from company statements are usually compared with industry averages. No attempt is made to separate profitable from unprofitable companies in the industry. As a result, the items involved in such enterprise-industry com-

### *The Search for Alternatives*

Having recognized the existence of a problem, management should seek as many promising alternatives as possible. Sometimes the processes of managerial planning are initiated by managerial dissatisfaction with some aspect of operations. More often, perhaps, the initiating cause is discovery of an alternate to current practice. Reading to discover problems almost always involves reading to discover attractive or plausible alternate courses of action. Most of the discussion of the nature and variety of problems of managerial planning in Chapter 4, for example, took the form of comparing two rival plans of action. Handbooks are particularly prolific sources of such suggestions.<sup>9</sup>

Often alternatives are found listed for convenient reference. This tends to be true in books on plant layout, material handling, production control, cost procedures, etc. Reference works give lists of materials with the properties of each, lists of processes, lists of material-handling equipment. A prolific source of suggestions in these areas can be found in advertising issued by manufacturers. A properly indexed file of catalogues such as is maintained by practically all purchasing and by most engineering and maintenance departments constitutes a reasonably exhaustive list of materials and mechanical aids.

Suggestion plans may enlist the cooperation of all employees both in discovering problems and in suggesting alternatives. Committees may play a useful role by bringing many points of view to bear on a problem. This usually stimulates thought and may evolve new possible plans for consideration. The process is quite unlike having a number of individuals each submit a plan, although that is one technique for getting a committee started on its deliberations. Consultants and directors may play a part, bringing an outside point of

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parisons have not been validated, *i.e.*, shown to be important or even oriented as to "better" or "worse." Presumably, optimum values exist with different dangers indicated by greater or smaller values. This would necessitate three bench marks: (1) an average of profitable companies, (2) an average of unprofitable companies that are unprofitable for reasons resulting in smaller than optimum values, and (3) an average of unprofitable companies that are unprofitable for reasons resulting in larger than optimum values. See Stephen Gilman, *Analyzing Financial Statements*, The Ronald Press Company, New York, 1934, and J. H. Bliss, *Financial and Operating Ratios*, The Ronald Press Company, New York, 1923.

<sup>9</sup> See especially Alford, *Cost and Production Handbook*, The Ronald Press Company, New York, 1934.

view and a greater variety of experience to bear on the problem. Purchasing agents should be alert for attractive alternative materials, methods, or equipment suggested by visiting salesmen.

Motion analysis is a technique for originating new and better alternatives. As an illustration, consider the problem of placing a single washer on each of a great many bolts.<sup>10</sup> Given a box of washers and a box of bolts, the operator almost inevitably picks up a washer in one hand and a bolt in the other. The washer is then placed on the bolt, and the assembly dropped into a third box. One of the "laws of motion economy" suggests combining "therbligs";<sup>11</sup> i.e., instead of picking up washers one at a time, the operator should pick up a handful. This sets the stage for application of a second law of motion economy—the work of holding an object should be transferred to a fixture. Once the washers are mechanically held, both hands are free to pick up bolts and output is drastically increased.

The technique of motion study is easily extended to work of a group, to a continuous assembly operation, or to processing a document through an elaborate office procedure. Simplification of motions into rhythmic repetitive patterns plus introduction of variations on a long list of standard mechanical gadgets often ends in complete mechanization. Thus, motion study becomes a fertile approach to machine design. H. P. Dutton suggests that scientific plant layout is essentially motion study applied to an entire factory and that plant location is a still broader application. Thus, motion study may become an important approach to the study of economic geography. Evidently the technique can be used to find and investigate alternative methods on many levels and is a much more versatile and powerful tool of management than it is generally conceived to be.

#### *Selection of Programs for Comparison*

As an illustration of listing of alternatives, consider a Minneapolis factory in a leased building with the lease expiring. The problem presented was one of choosing from among the following:

1. Sign a new lease and remain in the old quarters.
2. Move to new quarters in Minneapolis.

<sup>10</sup> A problem suggested by H. P. Dutton and used with considerable success in the laboratory teaching of motion study.

<sup>11</sup> See Barnes, *op. cit.*; Alford, *op. cit.*; or any other standard treatment of motion study.

3. Consolidate with another factory owned by the same company in St. Louis.
4. Move closer to markets for raw materials and for finished goods.
5. Move closer to markets, and bring St. Louis operations to the new site.

A logical approach to the problem involved analysis of a complex mixture of three types of cost variation: (1) variations due to change in physical plant and equipment, (2) variations due to consolidation of processing operations, and (3) variations due to location of the plant. Moreover, each of the major alternatives was itself a complex of minor choices. Moving to new quarters in Minneapolis, for example, involved the question of whether to lease, buy, or build and which of all available buildings to lease or buy or which of all possible types of buildings to erect. The alternative of moving closer to its buying and selling markets involved consideration of such sites as Chicago, Chicago suburbs, South Bend, and other places suggested by managers, directors, or consultants.

One approach is to resolve minor factors first, to the end that each major alternative is represented by a bona fide champion. For any but the smallest problems of managerial choice, this approach is difficult and tedious, tending to bog down in an infinitude of detailed choices. Given a problem as large as the plant location cited above, possible permutations and combinations of details are enormous. Long before all possible rival programs of operations could be listed, let alone analyzed, social change would have altered the terms of the problem enough to render all programs obsolete. Why waste time selecting the best available building in Minneapolis if the best plan proves to be a move to a Chicago suburb?

A better approach is to pick what superficially appears to be the best plan (or a typical plan) in each major group and by comparing these plans attempt to solve the major problem first or at least to limit it to two or three groups. Experience in the old quarters may be projected as a bench mark against which to measure other alternatives. Comparison of new buildings in Minneapolis, in Chicago, in South Bend may reveal so great an advantage in one, say South Bend, that all variations of Minneapolis or Chicago plans can be discarded at once. With most of the detail so eliminated, the study can continue resolving successive levels of detailed choices, eliminating as much as possible at each level. For example, a one-story building may prove so advantageous as compared with multistory that all variations including purchase or rental of multistory buildings

can be eliminated. By such successive eliminations, the choice can be restricted to manageable dimensions. The process ends when choice among alternate details involves cost differences too insignificant to be worth the costs of further study. Proper selection of termini requires forecasting the order of magnitude of differences between forecasts not yet made and comparing this estimate with a forecast of the costs of forecasting.

### CONSTRUCTION OF RIVAL PROGRAMS

#### *Need for Complete Programs*

The plans to be compared having been searched out and selected, each must be described accurately and in detail. Planning problems are interrelated as shown in Chapter 4. All policies and other plans adopted by a single enterprise are directed toward a common set of objectives and share a common environment. Such a structure or program of plans should be internally consistent. Each policy, each selection of equipment, each plan of every kind included in a program should support all the others. Conflicts increase costs and imperil achievement of the ends sought. Constituents of a program must be articulated, not merely tend in the same direction but follow a consistent pattern of timing. Whenever a problem of choice is discovered, all ramifications and implications of each selected alternative should be sought out and incorporated in an integrated, consistent program covering all contemplated activities of the enterprise. Managerial choices should be made among rival programs of such scope and cohesiveness.

There will be many situations in which the bulk of the program can safely be considered constant. Where this is known to be true for the structure or matrix as a whole, managerial calculations can be made in the limited terms employed in engineering economy studies. Always, however, a preliminary analysis of implications of each rival proposal should be made to determine the extent of the enterprise's whole program involved in the decision. By consistently approaching problems of choice as choice among complete programs, the probability of accidental omissions can be minimized. After the area common to all rival programs is ascertained, items identical to all programs can safely be omitted from further consideration.

Unless complete programs are considered, omissions are both probable and fatal to correct choices. For example, a foundry had been unloading scrap by crane. Volume declined, and cost per ton increased owing to spreading depreciation, insurance, and taxes over

fewer tons. Data were produced showing a lower cost per ton for manual unloading, and the crane was retired from service but kept against a day of recovered volume. Here was a serious omission. Instead of the cost of unloading by crane being compared with that of unloading by hand, the former should have been compared with that of *manual unloading and keeping an idle crane*. Correcting the comparison proved conclusively that the crane should be kept in operation at almost any conceivable volume of operations.

A complete statement of a managerial problem provides safeguards against omissions. Such a complete statement includes complete descriptions of two or more rival programs of action. Speed and economy are gained by identification and elimination of elements common to all rival programs. This should be done carefully and deliberately, never accidentally. Differences between programs are often overlooked because they enter cost records under labels that conceal their relevancy or as parts of nonhomogeneous aggregates. In most factories, much material handling and other indirect labor appears as direct labor in cost records because workmen do not punch in and out for every minor interruption.<sup>12</sup> Changes in timing of work will affect the amount of labor paid at overtime rates and demand charges for purchased power. Such items are merged in nonhomogeneous burden accounts and lost in a mass of subsequent arbitrary allocations. Too often the patterns of cost comparison follow patterns of traditional cost accounting. The relationship should be reversed; the pattern of the economy study should be imposed on the cost system.<sup>13</sup>

Usually one plan is continuance of operations as in the immediate past. This may be used as a standard against which other plans can be judged. The operations are known, and danger of omissions materially reduced. Unexpected repercussions and ramifications are minimized. Physical standards have been established and tested by experience. They are relatively easily priced by reference to past records. The entire program is summarized in the financial statements. By checking each item on the financial statements for changes, either financial or physical, for each alternate program, the

<sup>12</sup>I have seen 11 assemblers leave as many jobs for 15 minutes to help roll a 12-foot steel cylinder through a doorway. Nearly 3 man-hours of handling time on a single job was thus charged to direct labor cost of other jobs. In badly laid-out plants, especially if deficient in material-handling equipment, such occurrences may accumulate into a major factor.

<sup>13</sup>See "The Relationship of Engineering Economy to Cost Accounting," *Journal of Engineering Education*, April, 1941.



danger of serious omission is minimized. Plenty of difficulty remains in tracing the changes through the physical details and their financial implications.

### *Use of Physical Standards as Building Blocks*

As indicated in Chapter 5, physical standards of achievement, costs, and investment can be used as component elements of new plans. A planning problem is discovered and plausible alternatives listed by the methods outlined earlier in this chapter. The alternatives selected for study are elaborated into complete, detailed programs by ascertaining the content of each in terms of the physical activities required and their pecuniary implications. The process is greatly facilitated and precision improved by use of standards derived from observation and experience or from engineering calculations.

A company manufactured lockers and jobbed filing cabinets. It was urged to manufacture and give greater emphasis to its line of filing equipment. Here was a problem in the pattern elaborated in Chapter 4—should the company continue its current policy or adopt the proposed new policy? The policy of continuing as before could be elaborated in detail by simply projecting present standards and budgets into the future, making such adjustments as economic and competitive conditions seemed to require. The alternate program required an elaborate recombination of physical standards and a reappraisal of their pecuniary significance.

The company investigated the outlook for both file and locker industries, studied competitive conditions in each, and reappraised its own prospective standing in each under each of the proposed policies. Based on its findings, forecasts were prepared of company sales of lockers and of filing cabinets under each program. These forecasts provided a basis for adjusting projected data, assuming continuance of the old policy, and for elaborating the new program in terms of new combinations of old and new (calculated) standards. The locker program was considered to be identical under the two programs.

The volume of files anticipated for the new program, under which design, quality, and deliveries could be more closely controlled, seemed favorable, and the engineering department was directed to prepare drawings and specifications for the new line. The drawings enabled calculation of the quantities of each raw material and each purchased part required for one unit of each type of file contemplated. The specifications fixed all quality aspects of every material or part to be

purchased. Unit requirements were multiplied by appropriate sales forecasts, and the totals modified to provide inventories for service requirements and as a basis for continuing factory operations. The result was a complete program for purchasing direct materials.

The drawings and specifications were turned over to production engineering for design of tools, fixtures, and gauges. Here each part was analyzed as to operations required for its production. Appropriate machines were specified, and tooling plans developed. One result was a reasonably complete program of toolroom activity.

On the basis of the tooling data, the methods department developed synthetic standard times for setup and for standard runs for each operation. Multiplication by anticipated production schedules (sales forecasts plus inventory adjustments) gave machine-hours for each type of machine. Matching these hours against available time on present machines (not completely needed for locker production) and division by hours in a standard work week produced figures showing additional machines of each type required to implement the proposed policy.

The personnel department specified job grades for each setup and each operation. Adjusting machine-hours for situations in which several men operated one or several machines as a team or one man operated several machines, the personnel department calculated the added labor hours needed in each job grade. Matching these with data showing locker loads on existing personnel and division by the standard work week resulted in a determination of additional direct labor requirements.

The methods department superimposed templates of the new machines contemplated on a layout showing existing building characteristics, facilities, and machines. After suitable rearrangement to minimize material-handling costs, the layout showed where and how much additional processing and assembly space was required. Note that any existing idle floor space will be absorbed in the process.

Comparison of the contemplated layout with the existing enabled reasonably close estimates of additional indirect labor needed for materials handling, stock rooms, and maintenance. With the labor program virtually complete, estimates of additional locker, washroom, and cafeteria facilities were prepared, and the prospective volume of hiring, training, and counseling was estimated. Miscellaneous real costs, such as additional personnel and equipment needed by planning, purchasing, cost, personnel, accounting, and pay-roll departments, were estimated for the greater activity contemplated by

the proposed policy. Meanwhile, the sales department worked up estimates of media to be utilized and frequency of contacts needed to develop the anticipated sales volume.

By following through the physical ramifications and implications of each contemplated activity throughout the organization and across the entire chart of accounts, oversights were minimized and a complete program of physical activities necessary to the proposed policy was prepared. All this was dovetailed with existing plans for locker production and sale to absorb existing idle capacity wherever possible. As many favorable minor variations as could be found were worked into both old and contemplated programs to make the comparison as valid as possible. Since the contemplated program would be permanent, the span of anticipation was adequate for planning relatively complete adjustment—building, machine, fixture, gauge, tool, and personnel requirements were planned accordingly.

### *Conversion into Financial Terms*

Each of the physical activities contemplated for each alternate program must be assigned a pecuniary value in order to summate and compare the alternate programs. Moreover, management's goal is economic efficiency, which is itself measured in pecuniary terms. Such evaluations result in schedules of estimated future cash receipts and disbursements associated with each plan.

As indicated in Chapter 6, physical data are translated into pecuniary terms by a calculus of increments and opportunities reflecting managerial purposes and situations. Prospective materials, labor, and capital are figured at incremental values, *i.e.*, the added costs or revenues associated with added physical units. Sunk materials, labor, and capital (owned or fixed) are figured at opportunity values, *i.e.*, their values in alternate uses. Attention is focused on the differences in anticipated cash receipts and disbursements associated with the physical differences between rival plans. These generalizations are sharpened in the following paragraphs.

As problems emerge and concurrent situations become known or knowable, bills of material can be priced at appropriate current or anticipated values and extended by multiplication with actual or estimated usage, whichever is relevant. "Appropriate values" are determined by problem and situation, which govern such factors as which quantity discounts should be applied to each lot of materials to be purchased, what opportunity costs to each lot in hand, etc.

Thus, relevant and logical values are found for material costs associated with each rival program or for appraising differences between alternate programs. The span of anticipation will become a significant factor where vendors offer annual discounts or where enterprises own the sources of their materials. In the latter event, cost of materials may be greatly affected by changes in investment or in methods, the degree of change generally depending upon the span of anticipation.

As problems emerge and alternate programs are formulated, the number of cycles of each operation can be computed for each program. Current or anticipated wage rates for each operation can be entered, and extensions made and footed. Full effect should be given all factors discussed in Chapter 6 concerning behavior of direct labor costs; operations should be priced at overtime wage rates if elimination of the operation would enable rescheduling to avoid the overtime; where labor cost is fixed and idle time can be used, the item should be omitted as a "sunk" cost. Thus, relevant and logical values are found for direct labor costs associated with each rival program or for appraising differences between alternate programs. Due regard must be given the influence of the span of anticipation. This may require inclusion of contemplated changes in physical data through installation of new equipment or new methods. It may affect the selection of wage rates, *e.g.*, overtime vs. extra-shift premiums. It determines the period over which some labor costs may be regarded as fixed and therefore irrelevant.

The approach to burden estimating should again stress objective physical fact as far as possible. Many burden items are reducible to a physical usage basis: pounds of steam and tons of coal, kilowatt-hours, square feet of window area and hours of window washers' time, number of documents and of processing operations, to name a few. Proposed programs can be derived from past experience by considering physical changes in each income and expense item; *e.g.*, the proposed program may require an additional foreman, 500 more square feet of floor space, 60 kilowatt-hours more electric power per week, etc. Once the proposed program has been formulated in physical terms, it can be converted to pecuniary terms by analysis of the situation and the behavior patterns of costs and incomes. The additional foreman, considering the qualifications necessary and the state of the labor market, may cost \$3,600 per year. Existing departments perhaps can be compressed to yield the 500 square feet of space required at a cost of \$1,000 for moving present equipment. Additional

kilowatt-hours may be added in the 3-cent bracket. The span of anticipation plays its usual role in burden as in direct materials and direct labor. A program that increases burden items may require valuation of such increases at purchase market, at incremental cost of construction, or, if idle capacity in the item exists, at zero value until capacity utilization is approached. A program that decreases an item may require its valuation at resale or at value in an alternate use (opportunity cost). Usually all these concepts depend upon the time available for change from the existing to the proposed program and on the duration anticipated for the proposed program. For example, as machines wear out, idle machine capacity tends to disappear through utilization of previously idle capacity instead of replacement of the items worn out. A short-term plan may make no provision for replacement costs. A longer program will have to contemplate eventual replacements.

### *Summary Illustration*

A hosiery mill was considering discontinuing an outmoded line of 39-gauge hosiery. The line could be sold at a price reduced below "cost" as reported by orthodox cost records. However, management formulated a budget based on past operations of the company. Every estimate (note comparison of one whole program with a rival program) was analyzed for the effects likely to follow discontinuance of the 39-gauge line. Many cost items apparently would not be affected by the proposed change in product policy. Most costs (and incomes) directly traceable to other product lines appeared likely to be unaffected, *e.g.*, income from sales, direct material and direct labor outlays, and salesmen's commissions on other lines. Many overhead items appeared unlikely to be affected, *e.g.*, rent, salaries of major executives, property taxes, and advertising expenses. Although some of these overhead items had been partially allocated to the 39-gauge line in the cost accounts, such allocations were regarded as nominalisms and ignored.

Income from sale of 39-gauge hose appeared in the first budget (based on past operations and contemplating no change in product policy) but not in a second budget (showing anticipated results if the 39-gauge line were discontinued). Direct materials and direct labor incurred for 39-gauge hosiery were eliminated in the new budget. Power cost was reduced, and commissions on sales of 39-gauge lines were eliminated. However, the second budget contained an item

for sale of 39-gauge equipment. Depreciation expense associated with 39-gauge equipment was ignored (in both budgets) as a "sunk" cost. Technically, annual reduction in resale value should have been included in the first budget and not in the second; but for machinery making an obsolete product, the resale value had fallen to scrap value and no further reduction could be anticipated.

Before leaving the illustration, it should be noted that under different circumstances the items regarded as unlikely to be affected might also prove variable, *i.e.*, different in the two budgets. If the 39-gauge line were discontinued, income from sales of continued items might decrease owing to breaking of a full line or increase owing to suppression of cut-rate competition within the company's family of products. Total direct material usage might fall sufficiently to cause loss of one or more quantity discounts. Decrease in total direct labor might result in discontinuance of overtime work or through selective lay-offs in improved productivity per man-hour. Salesmen might find their incomes so curtailed by dropping the 39-gauge line as to necessitate relief through higher commission rates on remaining lines. While salaries of major executives might not decline, their effectiveness on remaining problems associated with continued lines might improve, resulting in an indirect saving through discontinuance of the 39-gauge line. Discontinuance of 39-gauge items might permit better layout of remaining equipment, with resultant economies in production of other lines. Such possible differences should be considered in arriving at a rational decision. Such considerations indicate the need for great care, familiarity with conditions, and good judgment in arriving at correct evaluations for physical activities contemplated by each rival plan.

A fact of greatest importance in all this figuring is the persistent use of increments and the complete absence of averages. Here is a contemplated change in plans or policies; what are the anticipated changes (increments) in costs and incomes? The averages characteristic of traditional cost systems, be they "actual" or "standard" systems, are excluded as irrelevant. A second fact of almost equal importance is the total absence of allocations of the traditional variety. The usual bases<sup>14</sup> are conspicuously missing. Analysis and experiment are substituted for arbitrary misuses of arithmetic. It is in this respect that alternate opportunities play an important role.

<sup>14</sup> See Specthrie, *Industrial Accounting*, p. 177, Prentice-Hall, Inc., New York, 1942, and also Chap. 6 of the present treatise.

Almost as persistent as the incremental approach is the pattern, "If this is not done, these resources will be made available, making possible this alternate course of conduct."

### COMPARISONS OF RIVAL PROGRAMS

Pricing reduces a variety of physical incommensurates to a single pertinent measure. However, the resulting pecuniary evaluations are not strictly comparable and should not be added or subtracted until investigation has disclosed that no major adjustments are required. When monetary expectations differ as to time of receipt or disbursement, adjustments may be needed to compensate for the opportunity values of rival programs following the compound interest law.<sup>15</sup> A dollar in hand has not the same present value as a dollar expected 10 years hence. Further adjustments may be required to give effect to differences in probability of occurrence. An asset seriously subject to chance destruction is not worth so much as an otherwise equivalent asset not so in peril.

#### *Compound Interest*

For meticulous accuracy, all receipts and payments should be reduced to the same time basis: either a single date as in present-worth computations or an equivalent flow of value as in comparison of annuities covering identical periods. Such adjustments may be important but are usually secondary, being overshadowed by obsolescence, uncertainty, and exhaustion by using up of resources. The adjustment, when necessary, involves estimating dates at which each cash receipt and disbursement is expected to occur if the plan with which it is associated is adopted, followed by application of compound interest formulas to reduce each program to a comparable basis.

The present author favors the annuity approach as staying closer to the form of managerial planning. Most programs involve much periodic repetition of physical acts. Because of natural seasons and the cultural pattern of the annual calendar, these tend to be planned in terms of successive repetitive years. The relatively few immediate outlays or occasional major expenditures contemplated can be easily reduced to equivalent annual interest and depreciation charges. This approach greatly facilitates preparation of responsibility budgets used

<sup>15</sup> Much attention is given this subject by writers on engineering economy, e.g., E. L. Grant, *Principles of Engineering Economy*, pp. 39-120, The Ronald Press Company, New York, 1938.

by management to control the operation of the selected program. These schedules of adjusted anticipated receipts and disbursements differ from typical, widely used budgets in the following respects:

1. Clear recognition of anticipated cash receipts and disbursements as the basic data in place of the mutilated "incomes" and "expenses" of traditional accounting.

2. Relating of such receipts and disbursements directly to physical activities contemplated in place of the maze of irrational allocations employed in traditional cost accounting.

3. Inclusion of owned assets on a basis of annual decline in resale values.

4. Computation of depreciation of contemplated acquisitions by the annuity method.<sup>16</sup>

Selection of the interest rate should give comparatively little difficulty. Management of private enterprise is concerned with alternate opportunities. Consequently, the question of what rate of interest to use can generally be settled by finding the answer to one of two questions: (1) What rate will have to be paid to secure additional funds? (2) What rate can be obtained in alternate employment of funds that may be released? The situation in which the planning problem occurs will indicate which question is the more appropriate and which in-

<sup>16</sup>The objection of accountants to the annuity method appears to rest on irrational tradition. Reasons are seldom given, merely dicta. Finney presents the argument for the annuity method lucidly and cogently but advises against its use without giving adequate supporting reasons for this conclusion, *Principles of Accounting*, pp. 275-276, Prentice-Hall, Inc., New York, 1934. Kester does not appear to understand the argument for the annuity method and certainly does not approve of it, *Advanced Accounting*, pp. 266-268, The Ronald Press Company, New York, 1933. The insistence on the use of compound interest formulas for adjusting values of bonds, leases, and annuities; their rigid exclusion in computing values of fixed assets, "current" debts, and intangibles; and the vacillation in this respect with regard to wasting assets are illogical and amusing.

In prospect we know that utilization will vary from year to year but cannot forecast which years will be high and which low. In these circumstances the annuity method is theoretically ideal. In retrospect we can know the utilization each year as the year ends. Fluctuations in utilization are likely to be much more significant than the adjustment for interest. In these circumstances there is much to be said for charging depreciation in the historical records on a service life basis. Accordingly, Hatfield accepts the annuity basis in approaching replacement problems, "Replacement and Book Values," *Accounting Review*, January, 1944, and Vatter prefers the service life basis for accounting records (criticism of first draft). Canning assumes an accurate forecast of utilization in arriving at an ideal approach to depreciation accounting, *The Economics of Accountancy*, Chap. 16, The Ronald Press Company, New York. 1929.



terest rate should be employed for the particular problem under consideration.

### *Risk and Probability*

Discounting for risk is more involved. In rare instances, the alternative to receipt or disbursement of a given sum is the complete cancellation of expectations. If so, an estimate can be made of the probability of occurrence, and the sum multiplied by this fraction either before or after discounting for any waiting period involved. Also rare are instances in which two definite alternate sums are involved. Here each can be multiplied by the probability of its occurrence, and the results added.

The most typical situation involves some most probable sum with a gradual diminution of probability for greater and lesser amounts. If the probability pattern is symmetrical about the most probable value, the actuarial value of the situation is equal to the most probable single value. This conveniently eliminates probability as a tangible factor in most managerial problems of choice. Because of the applicability of the law of diminishing utility, the economic value of an uncertain prospect is always somewhat smaller than the actuarial value. The difference increases as the dispersal of possibilities around the most likely result becomes greater.<sup>17</sup> Thus adjustments for economic value of risk are predominantly subjective and intangible.

### *Engineering Economy Studies*

Where the environmental matrix is invariant, detailed problems of managerial choice may be resolved by engineering economy studies. These typically deal with selection of product designs, processes, or productive resources.<sup>18</sup> Examples of such problems are (1) use of plastic or sheet metal for packages for leads for mechanical pencils; (2) whether to cut a groove in a toaster component to facilitate assembly; (3) hot or cold degreasing preliminary to painting; (4) use of engine, turret, or automatic lathe; (5) use of single or multiple dies for punch press (or patterns for molding operations); (6) reduction

<sup>17</sup> See Appendix I of Pigou, *Economics of Welfare*, The Macmillan Company, New York, 1942. Pigou treats symmetrical and asymmetrical cases with illustrations of each. He also introduces the principle of diminishing utility.

<sup>18</sup> See E. L. Grant, *Principles of Engineering Economy*, The Ronald Press Company, New York, 1938, and its companion volume *Problems in Engineering Economy*, and also W. N. Mitchell, *Organization and Management of Production*, Chap. 9 and associated section of the appendix, McGraw-Hill Book Company, Inc., New York, 1939.

of number of operations by substituting compound tools for a succession of simple tools; (7) use of shovels and wheelbarrows or of belt conveyors for moving sand, coal, ashes, or grain; (8) use of brick, concrete, or asphalt for road pavements; (9) installation of condensers or synchronous motors to reduce power factor penalties.

Comparison of rival plans on this level can follow the relatively simple and adequate pattern of engineering economy studies. Differences in physical aspects of rival plans are reduced to differences in estimated cash receipts and disbursements. These are sorted into columns according to the plan they favor, given algebraic signs to indicate receipt or disbursement, and assigned dates showing estimated times of occurrence. For convenience, items can be shifted from one column to another by reversing their algebraic signs.

Items involving essentially immediate outlays or receipts are segregated into an "investment" section in each column and footed. The difference between these totals is the excess or incremental investment of one plan as compared with another.

Deferred receipts and expenditures are adjusted by means of compound interest formulas to their equivalent annuities. For replacements of original investments, the annuity method of computing depreciation is used, giving due weight to both interest and exhaustion. These items are then algebraically added for each plan, and the difference between totals found. This is the incremental annual cost (or revenue) of one plan as compared with another.

If the plan with the least investment also has the greatest annual revenue (or least annual cost), it is clearly the most desirable. Usually the smaller investment is associated with the greater annual cost (or lesser annual revenue). Then the incremental cost (or revenue) is divided by the incremental investment to find the rate of return. Management then decides as to whether or not this rate of return is sufficient to justify the additional investment. This decision involves such intangibles as estimates of probable obsolescence and appraisals of reliability of all the estimates.

### *Use of Comparable Budgets*

More extensive rival programs are compared by preparation of budgets for each plan, culminating in estimated balance sheets and statements of profit or loss. The inclusion of every item in the chart of accounts helps prevent oversights and omissions. It places each alternate plan in the context of a complete program for future operations. This helps keep all plans oriented toward management's

ultimate objectives. It helps maintain internal consistency within each program considered.

Thus a national hardware jobber prepared four sets of budgets to compare (1) continuance as a national jobber, (2) contraction to local jobbing within a 300-mile radius of its home office, (3) gradual liquidation over a 2-year period, (4) immediate liquidation of all assets at forced sale prices.

A manufacturer of road machinery operating two factories prepared complete budgets to compare continuance of divided operations with the investments and costs associated with merging all operations in a single plant. The data showed a 30 per cent return (incremental annual cost reduction) on the incremental investment required to enlarge one plant to take care of the merged operations before any allowance for salvage or sale of the other plant. It would have paid the company handsomely to have given away a 270,000 square foot plant—ground, buildings, and equipment—if necessary to consummate the merger. Actually, salvage from the abandoned plant reduced the incremental investment to a point where return on remaining incremental investment reached several hundred per cent.

Such budgets are, of course, built up of physical standards evaluated by the calculus of increments and opportunities, adjusted for variations in time and risk, and finally appraised in the light of intangibles that have eluded the net of budgetary figures.

### *Factor Comparison Sheets*

Unfortunately, important and difficult as they are, physical and pecuniary descriptions are often overshadowed both as to importance and as to difficulty by intangible elements that defy the techniques discussed above. Data are never complete and seldom precise. Change is continuous and largely unpredictable. The human equation is not wholly amenable to the laws of logic. Among factors that are often important and usually intangible are the effect of a given plan on customer good will, the possibility of "spoiling the market," the likelihood of inviting adverse legislation, the possible need for flexibility, the chance of fomenting labor disturbances, and the probability of retaliation by competitors.

An illustration of the importance of intangibles is afforded by a company attempting conversion from peace to war production. This company had war orders totaling more than double its normal production, and it needed financial assistance to meet unprecedented outlays for machinery, tools, materials, labor, and out-of-pocket

burden. How large a loan would be required, and should a finance company make the loan?

Information as to processes, types of machinery, and tooling was secured from government arsenals. Machining time was calculated from dimensions given on blueprints, and cutting speed data furnished by machine-tool builders. This enabled computation of machine and tool requirements and machine labor time. Prices of machines and some tools were obtained from manufacturers. Bills of materials were available, and quotations were secured on all items specified. Thus machine and material costs were known reasonably exactly.

Present wage rates were known but were subject to change—presumably not very much change in the single year covered by the contracts. The company had long assembled intricate mechanical and electrical devices, so assembly time could be estimated almost as accurately as machining time. Past records and salary pay rolls told a complete story as to overhead expenses in the past. The tangibles were all relatively clean-cut and simple; it was the intangibles that hurt.

One product involved optical glass, purchased outside. It was obtainable in increasing quantities but had reached only 20 per cent of the scheduled shipping rate. How rapidly could more glass be obtained? This one critical factor fixed the shipping rate and consequently the time at which the company would be paid and could liquidate the proposed loan. Yet it was beyond control by the company, and conditions in the glass industry were too chaotic to permit accurate forecasting. Budgets based on two careful estimates of the rate of receipt of glass predicted loan maximums of \$1,000,000 and \$1,500,000.

A second product was an assembly job, produced in accordance with blueprints and specifications furnished by an engineering company. A few samples had been made that proved the engineering faulty. Materials had been purchased and had to be paid for as received, and overhead items continued to eat up cash. The necessary loan kept growing and could not be reduced until acceptable products were shipped and payment received.

The third product was a series of machined parts, assembled at a Naval loading plant. A sample of each lot had to be shipped to the loading plant and tested before the lot was released for shipment. In the absence of any experience with the item, who could predict the "bugs" to be encountered and the time it would take to get into

quantity production? And who knew how promptly the Navy would test sample lots, approve shipment, and make payment? Yet every month's delay increased the ultimate peak of the loan approximately \$200,000.

Often a large number of important intangibles enter into a managerial problem of planning. A useful device to bring such factors into some order to facilitate comparison is the factor comparison sheet. A separate column is devoted to each plan, and the intangibles are sorted into the columns according to the plan each factor favors. An attempt is made to judge relative weights, and the final result combined with such budgets as could be compiled to arrive at a decision. One such factor comparison sheet follows.<sup>19</sup>

ISSUE: SHOULD THE ANTIOCH SHOE PROJECT NOW UNDERTAKE NATIONAL ADVERTISING (AS IN *Good Housekeeping*, *Time*, BY RADIO, ETC.)?

## For

1. Long-time growth is based on ultimate consumer demand which needs to be aroused.
2. Project now has accounts in 33 key cities.
3. Retailers generally seem ready and anxious to sell the shoes.
4. Would enable company to take advantage of territorial style cycles—based on prestige of present accounts, such as Marshall Field.
5. Many additional accounts could be handled without much increase in factory stock of shoes.
6. New manufacturer has ample facilities to supply any demand, etc.

## Against

1. Demand created before it can be satisfied results in disappointment and loss of good will.
2. Would be difficult and unwise to expand facilities sufficiently rapidly to care for demand.
  - a. Only limited finances available.
  - b. Trained staff should not be recruited too fast in specialized project.
  - c. New accounts need careful promotion work centering around orthopedists, schools, hospitals, etc.
  - d. Retail sales people need training in fitting, etc., that we could not do adequately now.
  - e. New manufacturer should be tried out carefully as to quality of product, service, etc., before becoming too heavily committed.
3. Slow healthy growth, correcting mistakes as we go, is better in the long run.
4. Cost of such advertising in comparison with present methods, etc.

<sup>19</sup> From A. D. Henderson, *A Syllabus of Instruction for Business Policy*, Antioch Press, Yellow Springs, Ohio, 1931.

## PERIODIC REVIEW AND RECONSIDERATION

*Review and Reconsideration of New Plans*

Every adoption of a new program involves uncertainty and hazard. Unexpected ramifications may be discovered. Estimates prove erroneous. Conditions may change. There is always an element of experimentation, of trial, in each new plan adopted. Consequently, management should not consider the planning process completed with the adoption of a program. Its working out in actual operation should be carefully watched. Provision should be made for inspection and reporting of results. These should be compared with expectations, and deviations should be investigated. Perhaps the program has been misunderstood by subordinates, and additional instructions are needed. Perhaps further changes and adjustments are needed in the program. Perhaps the whole plan needs reconsideration; the entire problem may require reopening.

Estimating ability is improved by comparison of estimates with subsequent actual operations. In this manner, engineers and cost accountants learn to make their estimates more accurate and more complete. Managerial judgment is also nurtured by planning and subsequent follow-up to learn how these plans worked. Management learns both to respect and to suspect figures. The role of intangibles gradually emerges into clearer light.

*Periodic General Review—The Management Audit*

Even after inspection and review of the immediate results of the adoption of a new or changed program have proved its merit, management should not regard the matter as "finished business." Provision should be made for periodic review and reconsideration of the enterprise's operating program. This brings the chapter back to its beginning: the periodic survey of the operating program to discover faults and weaknesses; the search for problems, for worthy rivals to compare with the existing program; and the systematic analysis of such rivals to discover the most attractive.

## RELATED READING

See also footnotes 2, 4, 5, 6, 7, and 8.

GRANT, E. L.: *Principles of Engineering Economy*, The Ronald Press Company, New York, 1938.

MITCHELL, W. N.: *Organization and Management of Production*, McGraw-Hill Book Company, Inc., New York, 1939.

NEWMAN, W. H.: *Business Policies and Management*, South-Western Publishing Company, Cincinnati, 1940.

## CHAPTER 9

### ILLUSTRATIVE APPLICATIONS OF MANAGERIAL PLANNING

Purposes of the chapter: to give specific expression to the theory of managerial planning, and incidentally to develop at some length the managerial approach to three important problems: plant location, economic lot size, and pricing policy.

The analysis to this point has been somewhat general. Many short and unrelated examples drawn from actual experiences have illustrated various phases of the developing analysis. This chapter is devoted to three comparatively extended applications of the theory of managerial planning. The first is an adaptation of a portion of a study of plant location<sup>1</sup> that preceded the move of a Minneapolis factory to a Chicago suburb. The second explores the often discussed problem of the economic lot size from the point of view of managerial accounting. The third develops the managerial approach to the problem of setting prices on the wares of the enterprise. All were chosen because of the wide interest each problem excites in each of the major related disciplines of economics, accounting, and management.

#### PLANT LOCATION

A manufacturer of household electrical appliances, hereinafter referred to as Company T, occupied a four-story, leased building in Minneapolis. The lease had expired, and management was considering three alternatives: (1) renew the existing lease, (2) move to another Minneapolis location, (3) move to a location nearer its markets.

To avoid undue length and much partial repetition, the present account does not detail the analysis of all the locations considered, which included Minneapolis, St. Louis, Elgin, Melrose Park, Chicago Clearing, and South Bend. Instead, the available space is utilized to give comparatively full treatment to the analysis of physical and pecuniary differences between the old location in Minneapolis and a contemplated location in the BCG building in Melrose Park. The

<sup>1</sup> Study of Sessions Engineering Company.

actual move of the company to a different location was based on an entirely similar study in which many items were lifted directly or by adjustment from the study here presented.

### *Setting of Problem*

At the time of the study, the manufacturer was leasing space on a month-to-month basis. The area occupied was as follows:

Floor	Gross area	Net manufacturing area
Basement.....	630	630
First.....	10,240	9,757
Second.....	10,240	9,757
Third.....	20,480	19,514
Fourth.....	20,480	19,514
Total square feet.....	62,070	59,172

The remaining space in the building was leased by another company and was not available for future expansion.

The building was of modern steel and concrete fireproof construction. Bays were 16 feet 0 inches by 17 feet 0 inches, and the average ceiling height was 12 feet 0 inches. There were two freight elevators in the building, one of which was used by Company T and the other by the other tenant. General offices were located on the third floor, served by two stairways.

A flow chart showing the movement of the largest and most important component part showed four trips to a heavy press located in the basement; receiving, packing, and shipping on the first floor; two trips to the third floor for forming and one each for trimming, welding, and shearing; and one trip all over the fourth floor for plating and assembly. This made a total of 10 round-trip elevator movements for this one part.

Company T had plans for putting a new product on the market in the near future. The management did not believe the floor area sufficient to provide room for this production. We have already seen that room for future expansion was not available in the building occupied.

Operations were carried on at a disadvantage resulting from

1. Lack of raw material storage space



2. Lack of finished product storage space
3. Lack of a railroad siding
4. Improper and costly flow of material resulting from poor physical layout of space occupied
5. Lack of sufficient toilet and locker-room space
6. Lack of sufficient office space

### *Requirements of a Satisfactory Building*

Without making detailed layouts of all equipment and flow of materials in a specific building, it is not possible to forecast accurately how much additional space is required. Counsel was of opinion, however, that 20,000 square feet additional was needed at once, or a total of approximately 85,000 square feet of floor area. Sufficient land was needed to allow for eventual expansion up to 150,000 square feet or more.

A building for fabricating and assembling a considerable volume of small appliances should include the following features:

1. Modern steel and concrete or steel and brick construction
2. Complete sprinkler system
3. A minimum ceiling height of 12 feet with 15 feet or more under the monitors
4. A railroad siding
5. Ample trucking facilities
6. Complete services including power, sewage, gas, and water
7. Good lighting

Besides these essentials, consideration should be given column spacing, toilet facilities, and separate general offices. Although a one-story building is preferable, a multistory plant will prove satisfactory if each floor contains 25,000 square feet or more and the building meets the other conditions outlined above.

### *Basis of Expense Classification*

The survey and report were limited by agreement in three respects:

1. No analysis was made of the market for products of Company T.
2. The previous year's sales volumes and selling expenses were to be accepted as a basis for the report.
3. Intangible factors were excluded except for incidental discussion.

Preliminary trial balance figures reporting last year's operations were used as a standard to judge estimated expenses associated with each proposed location. With respect to each location (only one of which is here included), this question was asked and answered, "What would these expenses have been last year if Company T had been in

this location?" In view of business conditions at the time of the survey, it was believed that data and conclusions based on last year's operations were conservative.

The trial balance accounts are listed below. The accounts marked with asterisks are those which were most likely to be influenced by a change in location and character of plant facilities.

- Raw Materials
- Packing Materials
- \* Drayage In
- \* Productive Labor
- Testing Supplies
- \* Freight In
- Royalties
- \* Development Expense
- Installation Expense and Service
- Development Expense Special
- Development Fee Expense
- Supervision
- Foremen and Assistants
- Wages and Salaries Development Expense—Drafting Department
- Wages and Salaries Manufacturing Expense—Drafting Department
- Miscellaneous Development Expense—Drafting Department
- Shop Supplies
- Inspection Supplies, Lighting, and Electrical Equipment
- Anodes, Chemicals, and Materials for Plating Solutions
- Polishing and Buffing Materials
- \* Gas and Oil (Fuel)
- Small Tools Expense
- \* Power
- \* Light
- \* Rent
- \* Compensation Insurance—Factory
- \* General Insurance—Factory
- \* Taxes—Factory
- \* Repairs to Building
- \* Repairs to Machinery and Equipment (one-half labor)
- \* Repairs to Dies (one-half labor)
- Depreciation Machinery and Equipment
- Depreciation Dies
- Miscellaneous Development—Raw Materials
- \* Miscellaneous Development—Experimental Labor
- Miscellaneous Factory Expense
- \* Stockkeepers and Helpers
- \* Helpers and Laborers
- \* Setup Machines
- Losses on Discarded Equipment
- \* Labor on Repairs
- Miscellaneous Packing Material
- \* Packing Labor

- General Personnel Expense
- \* Jigs and Fixtures Expense (one-half labor)
- Patterns and Drawing Expense
- \* Factory Alterations and Installation Expense (one-half labor)
- Miscellaneous Patents Expense
- \* Clerical Employees—Factory
- \* Telephone and Telegraph—Factory
- Stationery, Printing, and Office Supplies—Factory
- Dues and Subscriptions—Factory
- Warranty Replacements—Commercial Products
- Officers' Salaries
- \* Officers' Traveling Expenses
- General Office Salaries—Officers and Department Heads
- \* General Office Expense—Clerical Employees
- General Office Expense—Engineers
- \* Office Rent
- \* Compensation Insurance—Office
- \* General Insurance—Office
- \* Group Insurance—Office
- Depreciation Office Furniture and Fixtures
- \* Taxes—Office
- Stationery, Printing, and Office Supplies—Office
- Postage
- \* Telephone
- \* Telegraph
- Credits and Collections
- Legal and Professional—Patent Suits
- Legal and Professional—Legal Fees
- Dues and Subscriptions—Office
- Exchange
- Officers' Life Insurance
- Miscellaneous General Expense
- Office Furniture and Fixtures Expense
- Office Alterations and Repairs
- \* Light—Office
- Bad Debts
- Donations
- \* Drayage and Deliveries
- \* Freight Out
- \* State Income Tax

To simplify the analysis, the following adjustments were made. Items that would not vary significantly with contemplated changes in location were omitted. Examples of such expenses are invoice prices of raw materials, patent and litigation expenses, and depreciation of machinery and dies. Items were combined that would vary in the same manner, *e.g.*, similar grades of labor. Where a trial balance figure contained both materials and labor and the account could be analyzed, only labor was considered. Where the amount was small or

the time required to analyze the amount excessive, it was arbitrarily assumed to be half labor and half material. The resulting basic data were as follows:

1. Freight In.....		\$ 14,740
2. Freight Out.....		53,096
3. Officers' Traveling.....		3,294
4. Telephone and Telegraph:		
Factory Telephone and Telegraph.....	\$ 1,001	
General and Administrative Telephone.....	1,298	
General and Administrative Telegraph.....	1,966	4,265
5. Drayage In.....		3,101
6. Drayage Out.....		6,981
7. Rent:		
Rent (includes water and extra heat).....	\$16,860	
Repairs to Building.....	411	
Office Rent.....	1,440	18,711
8. Power and Light:		
Power.....	\$ 7,420	
Light.....	3,604	
Office Light.....	400	11,424
9. Gas and Oil (Fuel).....		2,275
10. General Insurance:		
Factory.....	\$ 2,159	
General and Administrative.....	803	2,962
11. Direct Labor.....		325,478
12. Indirect Labor:		
Stockkeepers and Helpers.....	\$13,622	
Helpers and Laborers.....	9,286	
Packing Labor.....	2,916	25,824
13. Repair Labor on Machinery and Tools, etc.:		
50% of Repairs to Machinery and Equipment.....	\$ 5,625	
50% of Repairs to Dies.....	2,798	
Setup Machines.....	1,904	
Labor Repairs.....	11,967	
50% Jigs and Fixtures Expense.....	1,740	
Factory Alterations and Repairs—Labor.....	1,083	25,117
14. Clerical Employees:		
Factory Clerical Employees.....	\$ 6,411	
General Office Salaries—Clerical.....	17,659	24,070
15. Development Expense:		
Development Expense (labor only).....	\$ 3,557	
Miscellaneous Development—Experimental.....	2,294	5,851
16. Compensation Insurance:		
Factory.....	\$ 6,163	
Office.....	356	6,519
17. Group Insurance:		
Factory.....	\$ 390	
Office.....	253	643
18. Property Taxes:		
Factory.....	\$ 7,214	
Office.....	998	8,212
19. State Income Tax.....		18,336

*Comparison with Melrose Park Location*

The BCG building in Melrose Park was approximately 13 miles west of Chicago. It was three blocks from the Lake Street car line and was further served by an intermittent bus line. Highway connections were good, and there was a considerable local labor supply of suitable quality. The building had a railroad siding and loading platform along its entire north face.

The factory building was steel and brick with virtually continuous steel sash on all four walls. It had a wood roof with ample roof lighting from four monitors. The building was almost square, being

Account	Last year Minneapolis	Melrose Park BCG building	Increase (-) or decrease
Variable with Distance:			
1. Freight In.....	\$ 14,740	\$ 4,238	\$ 10,502
2. Freight Out.....	53,096	42,576	10,520
3. Officers' Traveling.....	3,294	1,294	2,000
4. Telephone and Telegraph.....	4,265	3,365	900
	\$ 75,395	\$ 51,473	\$ 23,922
Variable with Facilities:			
5. Drayage In.....	\$ 3,101	0	\$ 3,101
6. Drayage Out.....	6,981	0	6,981
7. Rent or Equivalent.....	18,711	\$ 19,691	- 980
8. Power and Light.....	11,424	15,140	- 3,716
9. Gas and Oil.....	2,275	2,000	275
10. General Insurance.....	2,962	1,550	1,412
	\$ 45,454	\$ 38,381	\$ 7,073
Variable with Wage Levels:			
11. Direct Labor.....	\$325,478	\$275,068	\$ 50,410
12. Indirect Labor.....	25,824	19,824	6,000
13. Repair Labor on Machinery.....	25,117	25,117	0
14. Clerical Employees.....	24,070	24,070	0
15. Development Labor.....	5,851	5,851	0
16. Compensation Insurance.....	6,519	5,540	979
17. Group Insurance.....	643	643	0
	\$413,502	\$356,113	\$ 57,389
Variable Taxes:			
18. Personal Property.....	\$ 8,212	\$ 8,212	0
19. State Income Tax.....	18,336	0	\$ 18,336
	\$ 26,548	\$ 8,212	\$ 18,336
Total.....	\$657,345	\$550,625	\$106,720

270 by 280 feet. Minimum ceiling height was 13 feet 8 inches with 18 feet under the monitors. A two-story and basement office building 38 feet 6 inches by 78 feet 8 inches was reached by a 25-foot covered passage from the factory building. Factory area was 75,600 square feet, office area 8,380 square feet, and land 17.2 acres. The building arrangements were almost ideal for Company T occupancy.

The schedule on page 197 presents the relevant expenses incurred in the preceding year's operations in Minneapolis and estimates of what these expenses would have been had that year's operations been conducted in the BCG building. The expense items are grouped roughly according to the major cause of variation: (1) expenses variable with distance, (2) expenses variable with facilities, (3) expenses variable with wage rates, and (4) variable taxes.

The following schedule shows estimated cash outlays required to secure and occupy the BCG building and the return on this investment anticipated through realization of the savings estimated in the preceding schedule.

Estimated cost of the BCG building:

7. Land.....	\$100,000	
7. Office building.....	22,000	
7. Factory building.....	<u>128,000</u>	
Total purchase price.....		\$250,000

Conditioning building for occupancy:

7. Washrooms.....	\$ 2,500	
7. Painting.....	2,620	
7. Partitions.....	480	
7. Fixtures and wiring.....	\$3,800	
Less sale of transformers.....	<u>1,125</u>	2,675
7. Piping.....		3,000
7. Machine foundations.....		<u>2,000</u>
Total cost of conditioning.....		13,275

Cash required for moving expense:

20. Taking down machinery and equipment...	\$ 2,500	
21. Moving machinery and equipment.....	14,011	
22. Setting up and installing.....	6,138	
23. Moving personnel.....	<u>7,150</u>	
Total outlay for moving.....		29,799
Total cash requirements.....		<u>\$293,074</u>

Return on investment:

Computed annual savings.....	\$106,720	
7. Add interest charged against rent.....	<u>6,570</u>	\$113,290
Per cent return on investment.....		38.8

The items shown in the two preceding schedules are estimated as follows:

*Freight In.* On the preceding year's volume, a Melrose Park location would have reduced freight bills on materials received by about \$10,502. The table below shows how this reduction was estimated. The total expense shown by the table is somewhat less than the trial balance figure because a number of relatively insignificant raw materials are omitted from the table.

ESTIMATED INCOMING FREIGHT COSTS ON MAJOR ITEMS  
OF RAW MATERIAL

From	Material	Freight cost Minneapolis	Rate per cwt. to Chicago	Est. cost Chicago
Chicago.....	1,631,407 lb. steel, aluminum, brass and wire	\$ 6,155	Free truck deliveries	0
Cleveland.....	105,401 lb. brass	1,465	\$0.58	\$ 611
Corning.....	6,472 lb. glass bowls	103	1.14	74
Grand Rapids....	42,528 lb. woodenware	374	0.30	128
South Haven.....	254,897 lb. wooden- ware	1,861	0.20	510
Moundsville.....	539,100 lb. glassware	3,604	0.3745	2,019
New Martinsville	10,615 lb. glassware	167	0.836	89
Newark.....	4,887 lb. wire	87	1.00	49
Biltmore.....	7,520 lb. mica	174	1.93	145
Waltham.....	37,208 lb. plate mica	685	1.65	614
Total.....	.....	\$14,675	.....	\$4,238

Estimated saving of Melrose Park location:

$$\$14,675 - \$4,238 = \$10,437$$

*Freight Out.* A Melrose Park location would have reduced freight out approximately \$10,520, calculated as follows:

1. Outgoing freight was distributed as follows:

	Pounds
To Chicago by truck.....	248,360
To Central zone by rail through Chicago.....	758,540
To Eastern zone by rail through Chicago.....	1,087,400
To Eastern zone via Duluth and Great Lakes.....	90,000
To Southern zone by rail through Chicago.....	202,800
To Northern zone by rail.....	127,400
To Western zone by rail.....	304,800
To Western zone by Mississippi and canal.....	75,000
Total shipped preceding year.....	2,894,300

270 by 280 feet. Minimum ceiling height was 13 feet 8 inches with 18 feet under the monitors. A two-story and basement office building 38 feet 6 inches by 78 feet 8 inches was reached by a 25-foot covered passage from the factory building. Factory area was 75,600 square feet, office area 8,380 square feet, and land 17.2 acres. The building arrangements were almost ideal for Company T occupancy.

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Less sale of transformers.....	<u>1,125</u>	2,675
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7. Machine foundations.....	<u>2,000</u>	
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To Western zone by Mississippi and canal.....	75,000
Total shipped preceding year.....	2,894,300

2. Of the trucking from Minneapolis to Chicago 95 per cent was at a rate of \$0.525 per hundredweight. The balance was at \$0.70 per hundredweight. If the factory had been located in Melrose Park, a Chicago suburb, this trucking would have been saved, reducing freight out by \$1,322.

3. Rail freight passing through Chicago from Minneapolis totaled 2,048,740 lb. The average increase in freight rates between Minneapolis and points beyond Chicago and between Chicago and these same points was \$0.569 per hundredweight. However, moving to Melrose Park would have added this same amount to the freight rate to Northern and Western zone points. The freight to these points totaled 432,200 lb. So the saving of \$0.569 per hundredweight would have applied only to the net of 1,616,540 lb.—saving of \$9,198 per annum.

4. The movement by lakes and river totaled only 165,000 lb. The difference in such water shipments originating at Minneapolis and at Chicago was small and extended by so small a volume was not an appreciable amount.

*Officers' Traveling.* A check of traveling expenses, as far as data were available, indicated over \$1,000 spent on Chicago trips by Minneapolis executives out of a total traceable of \$1,200. In addition, executives from the Chicago office incurred an expense of \$443 on trips to Minneapolis. This amount is not included in the \$3,294 shown in the preliminary trial balance. It was estimated that \$2,000 would have been saved annually in this item if the plant had been moved to Melrose Park.

*Telephone and Telegraph.* Of the total telephone and telegraph expense, \$1,020 was incurred on calls and telegrams between Chicago and Minneapolis. However, if the factory had been moved to the BCG building in Melrose Park, two direct wires to Chicago would have been needed at an annual cost of \$120. Net savings would have been \$900.

*Drayage In.* The BCG building was served by a sidetrack that would have eliminated this item entirely.

*Drayage Out.* This item was also eliminated by the siding.

*Rent.* The estimate for this item for the BCG building is composed of estimates covering the following items: (1) depreciation, (2) interest on investment, (3) real estate taxes, (4) insurance on building, (5) heat, (6) water. These items were estimated as follows:

1. *Depreciation.* Of an estimated purchase price of \$250,000, \$100,000 was assigned as the value of the land which was approximately 17 acres, \$127,500 as the cost of the factory building, and \$22,000 as the cost of the office building. The cost of making the building ready for occupancy would have been approximately \$13,275, composed of the following items:<sup>2</sup>

*Heating system.* The present heating system is steam with a vacuum return. Boilers are oil-fired. Factory heating is by five hot blast units;

<sup>2</sup> These items, to 2, are taken verbatim from the Sessions Engineering Company report.

the office by radiation. The system is in good working condition and has been found adequate during the most severe weather. No remodeling or rebuilding is required. Records on fuel consumption indicate an efficient heating system. Cost to recondition.....		\$	—
<i>Washrooms.</i> The factory has toilet-room facilities for 370 men, which is ample. No provision exists for women. A women's room can be built in the monitor thus saving floor space. Such a room with five toilets, 16 basins, cots, chairs, and separate stair, size 20 ft. 0 in. by 30 ft. 0 in. is needed. Office washrooms are now ample. Total for this item.....			2,500
<i>Roof.</i> The roof is in good condition and will not require an expenditure..			—
<i>Painting.</i> All exposed steelwork should be given one coat of gray oil paint to improve its appearance. Exposed steelwork is in good condition. The floor has been treated with concrete surface hardening and does not require painting. Paint on office walls and woodwork is in bad condition. Some plaster needs patching, and all woodwork should be refinished inside and out			
Factory painting.....		\$2,020	
Office.....		600	2,620
<i>Office partitions.</i> The BCG office building has only two private offices. The present library can be cut into two offices. The present general office would be divided into five large offices. We then have nine private offices on the first floor. Part of the second floor can be used as a general office. The plan would require 1,500 sq. ft. of partition at \$0.32 per foot. Cost is.....			480
<i>Power, light fixtures, wiring.</i> The office and factory are now equipped with adequate lighting fixtures. However, some of the new fixtures should be moved. A comprehensive wiring system is now installed that will meet general requirements. Extensions will be required to machine locations. These connections will cost \$2,500 for motors and \$1,200 for machine lighting. No new transformers will be required. We are assuming you will be able to sell transformers.			
Rehanging fixtures @ \$5.....		\$ 100	
Wiring for motors and local lights.....		3,700	
Sale of transformers, 225 KVA @ \$5.....		-1,125	2,675
<i>Fuel oil storage.</i> Two underground tanks complete with piping provide storage capacity for 12,000 gal., which is ample. New equipment.....			—
<i>Air, water, and steam piping.</i> Cost of present Minneapolis piping was about \$2,925. Since horizontal distances in the BCG building are greater and vertical distances less, we estimate the cost for this item will be.....			3,000
<i>Machine foundations.</i> Since all foundations will be on the ground floor, no reinforcing pads will be necessary. Cost of this item.....			2,000
Total for all conditioning.....		\$ 13,275	
Cost of factory and office buildings.....		\$149,500	
Total.....		\$162,775	

We estimate the life of this building as 50 years. On this basis, the annual depreciation would be..... \$ 3,255

2. *Interest on investment.* The interest on the investment was calculated at five per cent on one-half of the total investment above, plus the cost of the land, or..... 6,570

3. *Real estate taxes.* Real estate taxes on the BCG building were..... 3,904

4. *Insurance on building.* Insurance on stock company rates for BCG occupancy (which is similar to Company T), indicated an annual cost of 106

5. *Heat.* Records of BCG building showed a typical season's requirement was 100,416 gal. of oil. At a price of \$0.037 per gal., the cost would have been..... 3,715

6. *Water.* Water consumption was assumed equal to past consumption. The Melrose Park rate was \$0.30 per 1,000 gal., giving an annual cost of. 2,141

Total estimated rent..... \$19,691

*Power and light.* In addition to the former power load, the BCG building would have required 60,000 kilowatt-hours per year for oil burners, oil pumps, and vacuum pumps. The additional area would have required additional illumination. However, the daylight construction of the BCG building would have offset this requirement. Giving proper weighting to the demand charge, the former load plus 60,000 kilowatt-hours on rate D of the Public Service Company of Northern Illinois was estimated at \$15,140.

*Gas and oil.* Annual gas consumption on rate 2 of the Public Service Company would have cost annually \$1,002. Oil other than for heating would have cost approximately \$0.037 per gallon. Assuming that the same quantity, 26,895 gallons, would have been used, the annual cost would have been \$998. Total cost for both, \$2,000.

*General insurance.* The rates for 1 year for the BCG building multiplied by 2.5 to make them comparable to the 3-year rate at Minneapolis (which was 0.658) gave the following:

General insurance:	
Factory.....	\$ 910
Office.....	340
Sprinkler leakage.....	300
Total.....	\$1,550

*Direct labor.* The table immediately following compares Company T average labor earnings for various classes of labor with Chicago rates supplied by the Illinois Manufacturers' Association. The latter were revised upward in some instances to reflect the experience of a manufacturer of electrical appliances near Melrose Park. A flat 10

per cent was added to these rates for quality labor. Differences between these rates, 10 per cent above the Chicago averages and Company T rates, were extended as possible hourly savings. By multiplying the number of men affected by each rate and by the number of estimated working hours, a possible saving of \$50,410 was estimated in direct labor.

## ESTIMATED SAVINGS IN DIRECT LABOR

Labor classification	Company T average rates	Adjusted rates for Chicago	Difference	Number of Company T employees of each class	Savings per year *
Welders.....	\$0.855	\$0.720	—\$0.135	5	\$ 1,350
Screw machine operators.....	0.755	0.720	— 0.035	14	980
Drill press operators..	0.710	0.605	— 0.105	10	2,100
Punch press operators	0.750	0.605	— 0.145	30	8,700
Other machine operators.....	0.650	0.605	— 0.045	35	3,150
Metal polishers.....	0.920	0.680	— 0.240	47	22,560
Metal platers.....	0.600	0.660	+ 0.060	7	—840
Assemblers.....	0.690	0.605	— 0.085	73	12,410
Total.....	.....	.....	.....	221	\$50,410

\* Figured at 2,000 hours per year for each employee.

*Indirect labor.* Twenty-nine men were classified as nonproductive labor. Allowing for packing, die-setting, etc., there were the equivalent of 12 full-time jobs handling materials at \$0.50 per hour. Improved layout, made possible by greater floor area and by opportunity to relocate machines relative to each other in the course of moving, should have reduced the time spent in moving materials by half. This straight-line flow with back-hauling and cross-hauling minimized should have reduced material-handling cost by \$6,000 per year, which saving is shown in indirect labor.

*Repair labor on machinery and tools.* Although the analysis of direct labor indicates some saving in this item, the amount is omitted owing to the difficulty of making a proper analysis.

*Clerical employees.* The pay roll of Minneapolis clerical help was in line with Chicago rates.

*Development labor.* See note on Repair Labor above.

*Compensation insurance.* The Minneapolis compensation was \$1.415 per \$100. The Melrose Park rate was \$1.35 per \$100. If the pay roll did not change, the premium would have been

$$\frac{\$6,519 \times \$1.35}{\$1.415} = \$6,300$$

However, the pay roll would have been decreased by \$56,410 savings in direct and indirect labor shown above. This requires a further reduction of  $\$56,410 \times 0.0135 = \$760$ . Thus, \$6,300 less \$760, or \$5,540, would have been the premium required in Melrose Park, a saving of \$979.

*Personal property tax.* There would have been a change in this item. However, the item is frequently affected by unpredictable factors, so no attempt was made to estimate the amount.

*State income tax.* Illinois does not have a state income tax, so this amount was taken as a saving.

*Taking down machinery and equipment.* This item includes the estimated cost of dismantling all machinery and equipment and crating all small stores, parts, etc. It was estimated at \$2,500.

*Moving machinery and equipment.* This item includes taking machinery and equipment off floors, trucking to cars, and crating in place in cars. It also includes freight from Minneapolis to Chicago. It was calculated as follows:

Pickup and delivery to cars.....	\$ 3,600
Freight:	
8 cars machinery.....	1,171
40 cars miscellaneous.....	9,240
	<u>\$14,011</u>

*Setting up and installing.* This item includes unloading the cars and moving the machinery to position and actual installation. The cost of unloading was estimated on a basis of about \$30 per car for machinery and about \$20 per car for equipment. The cost of setting was estimated to be approximately \$5,138. Total cost would have been \$6,138.

*Moving personnel.* The following table is an estimated list of personnel that would have been moved with suggested allowance for cost of moving:

TABLE OF PERSONNEL MOVED

	Allow- ance for moving
General and administrative:	
Vice-president in charge of sales.....	\$1,000
Vice-president in charge of production.....	1,000
Domestic sales manager.....	700
Assistant domestic sales manager.....	250
Office manager and commercial sales manager.....	700
Assistant office manager.....	250
Secretary to vice-presidents.....	250
	<u>\$4,150</u>
Factory superintendence:	
Superintendent.....	\$ 500
Assistant superintendent.....	250
Purchasing agent.....	500
	<u>\$1,250</u>
Factory foremen and assistants:	
Machine shop.....	\$ 250
Domestic assistant.....	250
Commercial assistant.....	250
Domestic inspector.....	250
Subassembly.....	250
Heating unit assembly.....	250
Plating.....	250
	<u>\$1,750</u>
Total.....	\$7,150

### *Conclusion*

Other similar studies were made for rival locations. Compound interest adjustments appeared relatively insignificant and were consequently neglected. Some idea of the accuracy of such estimates may be obtained from the experience of Company T. The final decision was to build a new plant in a Chicago suburb. Investment was estimated at \$250,000. Actual investment reached \$300,000 but included air conditioning of offices and insulation of factory roof not contemplated in the estimate. The building was approximately 250 by 450 feet, single story, with a second-story office across one end, 60 by 250 feet. Estimated annual savings were \$125,000; and as near as could be ascertained, actual savings were almost \$250,000 per year (before income tax!).

## ECONOMIC LOT SIZE

The problem of the economic size of manufacturing lots in intermittent-repetitive plants is an example of considerable complexity and wide applicability. Some costs associated with a shop order occur once with each order. Large orders are desirable to spread such costs over a large number of units. Other costs depend upon the investment in inventory. Small runs minimize investment in inventory and keep these costs low. The economic lot size is the optimum compromise at which the sum of these two groups of costs is minimized.

*Derivation of Formula*

A widely used formula is derived by (1) analyzing the total annual cost of production into components differently influenced by the size of the production run, (2) differentiating with respect to lot size, and (3) setting the differential equal to zero and solving for the economic lot size. The three steps follow:

1. The total annual cost of producing a commodity is equal to the sum of the following:

- a. Fixed costs, *e.g.*, executive salaries, depreciation
- b. Unit costs multiplied by annual quantity produced
- c. Order costs multiplied by number of orders per year
- d. Carrying charges multiplied by value of average inventory

The number of orders per year is equal to the quantity per year divided by the lot size. The average inventory is equal to a constant minimum cushion plus one-half the lot size. Putting this analysis into symbols, the following equation results:

$$T = F + U \times Q + S \times \frac{Q}{L} + C \times U \times \left( K + \frac{1}{2} L \right)$$

2. When this equation is differentiated with respect to the lot size  $L$ , all constant terms (those not involving lot size) drop out and the following equation results:

$$\frac{dT}{dL} = \frac{1}{2} C \times U - S \times \frac{Q}{L^2}$$

3. To find the lot size resulting in minimum total annual cost, this equation is set equal to zero and solved for the economic lot size:

$$L = \sqrt{\frac{2 \times Q \times S}{U \times C}}$$



To use this formula effectively, cost records should report or should provide a basis for calculating or estimating

- a. Annual quantity  $Q$
- b. Order costs  $S$
- c. Unit costs  $U$
- d. Carrying charges  $C$

Furthermore, these costs should be computed in the sophisticated managerial way as increments or opportunities (see Chapter 6), and not as allocated averages in the naïve manner of traditional cost accounting.

### *Annual Quantity $Q$*

Annual quantity, for this purpose, is the number of units of the item in question estimated as necessary to fill shipping requirements for the ensuing year. A good sales budget based on careful market analysis should show estimated shipping requirements in units of every product sold. These requirements should be adjusted for present inventories and for desired year-end inventories. The adjusted requirements should be analyzed into parts, and requirements for interchangeable parts merged. These assembly requirements should be adjusted for present inventories and for desired year-end parts inventories. The result is a production program showing quantities of all products to be assembled and of all parts to be produced during the ensuing year. The number of units shown in this program for the assembly or part whose economic lot size is to be determined is the  $Q$  of the economic lot size formula.

### *Order Costs $S$*

Order costs are costs that vary with the number of orders and are relatively independent of size of order and of total annual quantity produced except in so far as these two items taken together determine the number of runs per year. The major order costs are setup cost, costing cost, planning cost, and sometimes material-handling cost.

*Setup costs* include all costs of securing tools, dies, jigs, and fixtures; all costs of die-setting, setting up of screw machines, etc.; and all take-down costs, including removal and stowage of tools, dies, jigs, and fixtures. These costs are not easily recorded or estimated. Most conventional cost systems merge setup labor cost with operating labor cost under the mutually inclusive term *direct labor* or completely lose setup labor cost in departmental or factory burden either in a very

general Indirect Labor account or in an unanalyzed Setup Labor account. Furthermore, successive setups of the same operations may legitimately differ widely in cost. If a screw machine job uses the same diameter bar stock as the preceding job, the collet will not need changing and from 20 to 50 per cent of the setup time will be saved. The tools in some faces of the turret may not require changing, or the change involved may be very simple as when a drill or tap is replaced by another of different diameter. Similar situations arise with respect to bolster plates on punch presses, and with respect to index heads, or other special fixtures on milling machines.

An operating labor cost is also involved owing to time required to pick up speed on a new job or after a shift from one job to another. This is particularly important on assembly work where other setup costs may be small. Continuous assembly lines are likely to contain special fixtures and tooling and may have unusually large setup costs in adjusting and retooling for a change in product.

All these costs are incremental or opportunity in character. If this run or sometimes a certain percentage of all runs could be eliminated by consolidation with other lots, (1) how much could the total wage bill be cut, or (2) what is the value obtainable by alternate employment of time saved by consolidating lots? This may run into minor ramifications in various burden items, such as supervision and space charges. Also, direct materials cost will be affected where adjustments made in setting up equipment, *e.g.*, screw machines, involve a certain amount of spoilage.

*Costing cost* is the cost of cost finding. It includes cost of clerical time and stationery. Usually it can be reasonably approximated by accumulating the incremental cost of operating a cost department, *i.e.*, the costs that would be saved if the cost department were abandoned, and dividing the total of such costs for a period by the number of orders (lots or runs) processed in that period. This cost per order is not exact, as there is considerable variation in the number of requisitions and time tickets associated with "an order." There may also be ramifications in burden items such as supervision, space occupied by cost department, costs associated with use of office equipment, etc. Pay-roll department costs are here considered included in costing cost.

All these costs must be approached as incremental or opportunity costs. Costs associated with use of present office equipment are opportunity costs—values obtainable by transfer to other departments or by deferred replacement. Costs associated with new office equip-

ment made necessary by increased number of lots are, of course, to be viewed as incremental costs. In smaller companies the clerical expense of cost finding may be essentially fixed. There may be only a few clerks who could handle substantially more orders, and yet a considerable reduction in number of orders may not enable a reduction of a whole clerk. Opportunity for alternate uses of released time may or may not be present but, if present, will usually be at a different value level, *e.g.*, preparation of reports hitherto deemed of submarginal value. Fluctuations of clerical loads may interfere with effective utilization of a few hours released by consolidating lots. Each situation requires analysis, and ultimately decisions must rest upon judgment based on partial data.

*Planning costs* are costs of routing, scheduling, and dispatching shop orders. Being clerical costs dependent upon the number of documents handled, *i.e.*, upon the number of orders, they are subject to the same analysis as costing costs given in the preceding paragraphs. Sometimes two standard planning costs per order are needed: one for standard, repetitive orders where many documents can be drawn from files and reused and another for special orders where routing, scheduling, etc., must be done *de novo* for each order.

*Material-handling costs* in factories producing light, assembled products, *e.g.*, watches or automobile accessories, are likely to be determined by number of orders rather than by number of pieces. In such factories, parts are often handled in cake tins or bread pans, usually less than 30 per cent filled. Each order requires a trip by a material move man from stock room to assembly line. If each order were twice as large, *i.e.*, half as many orders per year, each pan would contain twice as many pieces, each trip would involve the same number of pans, and there would be half as many trips. In such a plant, material-handling labor cost can be divided by the number of lots processed in the same period to approximate the cost of materials handling per order. The incremental-opportunity analysis obviously applies to these costs as to all other computations pertaining to managerial planning.

Plants producing to sales order may find that engineering costs, traveling expenses, advertising (especially direct by mail), order writing, credit granting, and debt collecting all imply order costs, tending to vary with number of orders rather than with annual volume.

Note, however, that larger orders may make more elaborate and costly setups economically desirable by multiplying saving of direct labor cost per piece by a sufficient number of pieces. Other items

may exhibit similar phenomena; *e.g.*, sales engineering might be much more meticulous and expensive for large orders than for small.

### *Unit Costs U*

Unit costs are costs that vary with annual quantity produced and are relatively independent of size of lot or number of lots. Unit costs usually include direct material, processing labor, and some variable burden. These costs enter the formula to translate the average physical inventory into an investment item to serve as a basis for calculating insurance, interest, taxes, etc.

Direct material and processing labor costs are subject to the analysis made in Chapter 6. For example, calculation of investment in inventory for this purpose will depend upon treatment of quantity discounts and overtime premiums. Reducing the lot size will reduce the average physical inventory and thereby reduce investment in inventory, perhaps by reducing the amount of overtime labor incorporated in stocks on hand.

Variable overhead in this connection includes kilowatt-hour charges and sometimes material-handling costs. Some "variable overhead" appears to vary with annual output because a larger annual output usually means running more lots. Overhead items that vary with annual output for this reason should not be included among the "unit costs" here discussed. The correlation of demand and peak charges for power with annual output in units is complex and may sometimes be properly included. Material-handling costs are generally properly included where parts are large and heavy, *e.g.*, overhead cranes or bulldozers, each single piece requiring a trip by a move man. Thus, if an order is twice as large, there will be twice as many pieces and twice as many trips.

In considering proper inclusions in "unit costs" for this purpose, it is clear that order costs and fixed (not overhead) costs should be omitted and that remaining items should be included at incremental or opportunity values depending upon whether such items are being currently replaced (incremental) or not (opportunity).

### *Carrying Charges C*

Carrying charges include all costs that vary with the size of an investment—in this instance, in inventory. They include interest, personal property taxes, insurance on contents of building, shelf wear, obsolescence, space costs, and certain labor charges. Most of these are so definitely proportional as to be most easily estimated as a percentage of the value of the inventory.

Whatever accountants and cost accountants think of interest as a cost,<sup>3</sup> interest does cause management to tend to minimize investment, in inventories as elsewhere. The percentage to be used for interest depends upon opportunities open to management. If available cash discounts are being lost because of poor working capital position, the rate used for interest in figuring economic lot size may properly be as high as 30 or 35 per cent. If the company is investing excess cash in government bonds paying 1 per cent or less, the rate used in figuring economic lot size should be correspondingly low. The accountant's criticism of interest as a cost as a vague matter depending on managerial judgment is true enough; his conclusion to ignore interest as a cost is plainly a fallacy. Management should estimate the rate and incorporate interest cost wherever appropriate, certainly in computing economic lot sizes.

Personal property taxes may be a fixed rate on an assessed value, itself a fixed percentage of cost, or it may be highly subjective. One company reported no change in personal property taxes after adding approximately 40 per cent to their machinery and inventories. Much depends upon the way in which the tax is administered and sometimes on the "connections" management has with taxing officers. Typically the item is rather small, usually not in excess of 1 or 2 per cent.

Contents insurance tends to vary in precise proportion to value of contents. The rate is stated at so much per \$100, and the company sets the face of the policy at whatever is believed necessary for adequate protection. The item varies considerably, depending on exposure, sprinkler system, and many other factors.<sup>4</sup> In all cases it tends to be small, usually less than  $\frac{1}{2}$  per cent.

Shelf wear, under given conditions of stowage and handling, depends primarily on length of time on hand, which tends to be proportional to size of inventory. Practically all goods are subject to deterioration: rubber by oxidation, many liquids by evaporation, painted items by chipping and scratching, finished surfaces by nicking or scratching, steel by rusting, wood by warping, etc. The rate of deterioration varies widely with the material and with shop conditions and methods. It can run over 20 per cent per year or may be kept as low as 2 or 3 per cent.

Obsolescence varies irregularly with time. It is the hardest of all these items to estimate and often is the most important single item in the group. In some industries annual models result in accurate

<sup>3</sup> Scovell, *Interest as a Cost*, The Ronald Press Company, New York, 1924.

<sup>4</sup> Installation of a sprinkler system may cut the rate as much as 90 per cent.

forecasts of obsolescence. However, in such industries inventories are run down to the quantities needed for service stocks in anticipation of the model change. Competitive industries, especially where competition runs in terms of style, are likely to have high obsolescence rates. Stable industries, especially monopolies, exercise considerable control over product obsolescence, and rates in such industries will be correspondingly low.

Space costs depend on alternate opportunities available to management. The company may be able to lease the space, in which event, rent that would be received measures the space cost. Or the company may be renting the space and able to reduce the area leased and the rent paid, in which event, the reduction in rent may be the appropriate measure of space costs. In many instances, the alternate is relieving congestion in other departments, and "space cost" becomes a somewhat vague estimate of labor saving and reduction of machine waiting time made possible by relieving congestion.

The labor element in carrying charges is easily overestimated. Most stock-room labor does not depend upon the size of the inventory but instead upon the size and number of orders cleared through the stock room. Some labor is increased by increasing the size of the inventory, most particularly labor needed to count items periodically as a check on the perpetual inventory record maintained in the cost department.

Carrying charges, as a whole, are usually estimated somewhere between 10 and 25 per cent.

#### PLANNING PRICES

Management sets prices on the products of the enterprise. These prices are set in an effort to maximize profits. Depending on circumstances, this goal may be approached (1) directly, (2) by attempting to calculate price minimums below which business should be refused, (3) by deciding problems concerning elimination of lines or items from a company's offerings, (4) by analysis of the opportunity and desirability of price discrimination, or (5) by reference to the intangibles of the situation.

#### *Direct Seeking of Maximum Profit*

The monopolistic-competitive school of economics assumes that the management of each enterprise, be it monopolist, competitor, or in between, seeks to set prices which will maximize profits for the enter-

prise.<sup>5</sup> Accountant and economist agree that management seeks to maximize the spread between total income and total cost. This occurs at that volume at which marginal revenue equals marginal cost.

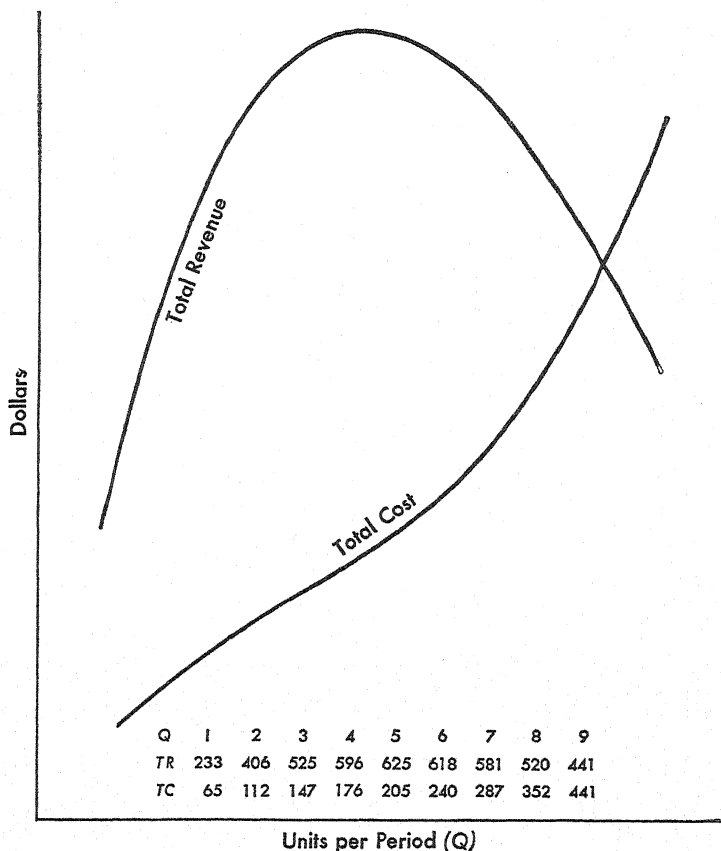


FIG. 5. Theoretical total revenue and total cost curves.

Further analysis requires consideration of the effect of price on number of units sold and of physical output on costs.

Managements, as well as economists, recognize that increasing volumes can be forced on the market by decreasing price or by in-

<sup>5</sup> Triffin, *Monopolistic Competition and General Equilibrium Theory*, Harvard University Press, Cambridge, Mass., 1940.

Chamberlain, *Theory of Monopolistic Competition*, Harvard University Press, Cambridge, Mass., 1938.

Meyers, *Elements of Modern Economics*, Prentice-Hall, Inc., New York, 1941.

creasing outlays for sales promotion. Total revenue, after deducting costs of sales promotion, is known from general reasoning to be negligible both for enormous volumes at prices approaching zero and for enormous prices at vanishing volumes. Somewhere in between, total revenue less costs of promotion reaches a maximum (see Fig. 5).<sup>6</sup> Differentiating such a curve yields an incremental or marginal revenue curve, which falls with increasing volume.

From an enterprise or management point of view, price determines volume and volume determines cost. In a zone of comparatively small volumes, increasing volume makes possible the advantages of more elaborate specialization;<sup>7</sup> and in the short run, the spreading of capacity costs over larger volumes. At large volumes, further increases tend to increase prices of agents of production as they are progressively bid away from ever more urgent alternate uses, to increase costs of coordination, and in the short run, to encounter diminishing returns as plant capacity is strained to the utmost. Thus, increments of cost, which are compared with increments of revenue to discover the maximum profit volume, tend first to fall with increasing volume, reach a minimum, and thereafter tend to rise (see Fig. 6).

The content of "incremental revenue" and of "incremental cost" depends upon the span of anticipation. The longer the period contemplated, the more complete can be the adjustment of buyers and of competitors to price changes initiated by the enterprise. Management must consider the reaction of buyers to the pricing policy adopted. Will lower prices bear immediate fruit in moving larger quantities, or will buyers tend to hold off in anticipation of further reductions? Will they take advantage of low prices to lay up stocks against future needs, thereby spoiling future markets? Meantime, how will competitors react? How will they readjust their prices and their investments? Will new competitors invade the market or submarginal competitors withdraw? Will such changes require further adjustment of price policy by the subject management?

"Long-run" price, or equilibrium, can be given definite meaning. It is conceived to be the final price, or equilibrium, that would be

<sup>6</sup> Graphical presentations of "flexible budgets" or "profitgraphs" tend to ignore this known shape of the revenue curve, to portray it as a straight line passing through the origin.

<sup>7</sup> See "Economies of Large Scale Production" in Mitchell, *Organization and Management of Production*, p. 38, McGraw-Hill Book Company, Inc., New York, 1939. Also, "How and Why Large Plants Bring Economy" in Clark, *Economics of Overhead Costs*, p. 104, University of Chicago Press, Chicago, 1923.



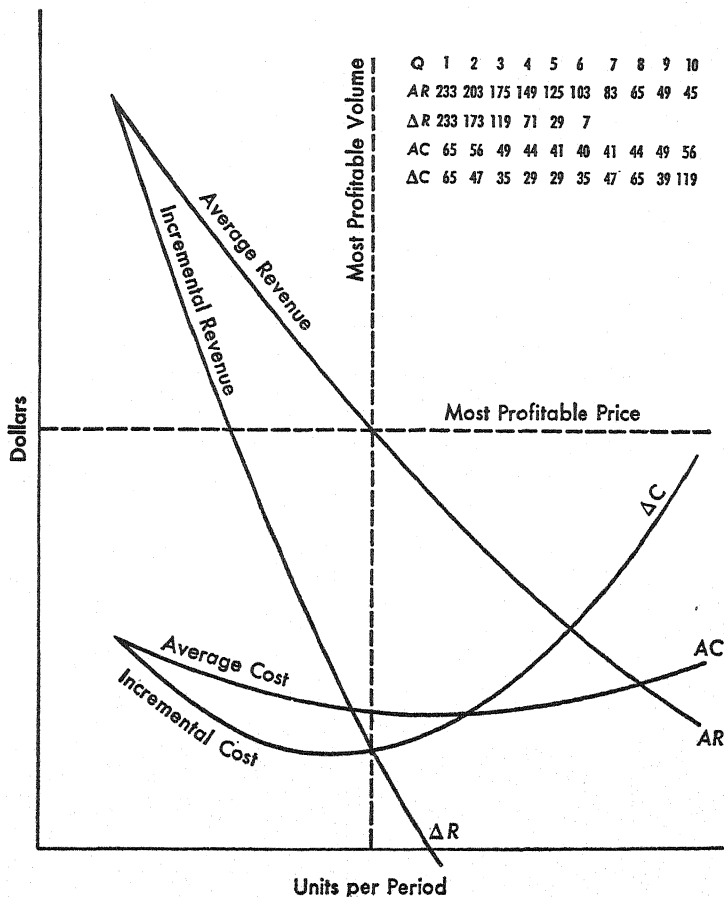


FIG. 6. Theoretical average and incremental cost and revenue curves.

Note: The data shown are derived from those shown for Fig. 5: averages are derived by dividing totals by appropriate quantities, increments by finding differences between successive totals. The average and increment curves shown in Fig. 6 are all parabolas. All ordinates—totals, averages and increments—are positive integers. Consequently all solutions are also integers. (If the data be regarded as covering an industry instead of an enterprise, both monopoly and competitive solutions are integers.) Finally, by not indicating scales, the diagrams represent a large number of possible situations. For example, units per period may be units per second, per day, per week, or per any other time interval. Or all ordinates can be multiplied by any desired constant. All this makes possible easy construction of clean-cut problems in price theory.

achieved after all adjustments have been made, and no enterprise can gain by changing its investment or its price. "Short run" cannot be given so definite a meaning. Representing partial adjustment, it has as many meanings as there are degrees of adjustment. Time enables more complete adjustment by management of output to the optimum for the plant capacity; and given enough time, management can change plant capacity itself in its quest for lower costs. Today, management may increase the rate of consumption of inventories and the hours of overtime worked by men and equipment. By tomorrow, management may add a few hand tools and a few unskilled or partially skilled workmen. In a week or two, management may increase available hand tools and workmen appreciably. In a few months, space, heavier equipment, and specially trained workmen may be increased. Over the spans suggested, all these increases are sharply limited, but these limits widen and become vague as the time allowed increases. Every way station on the road of expansion constitutes a different "short-run" condition, and even these conditions will vary as between different final goals of management. An increase will be achieved by one means, *e.g.*, overtime operation, if conceived as temporary; by another, *e.g.*, more or larger machinery, if believed permanent; and by still a third, *e.g.*, a branch plant in a new territory, if the increase is incidental to a larger program.

Thus, we conceive both marginal revenue and marginal costs as surfaces, having time as a third dimension: the effect on volume produced by changing price depends upon the time allowed for buyers to readjust their habits and for competitors to react to the changed situation in which they find themselves, and the effect on cost produced by changing volume depends upon the time available for management to readjust output and plant capacity to such changes. As successive sections are made perpendicular to the time anticipation axis, successive short-run cost and revenue curves are obtained. Shapes of these curves change at diminishing rates until a time is reached at which buyers, competitors, and management will have made their ultimate adjustments. Thenceforth the sections are constant and exhibit long-run cost and revenue curves. Both cost and revenue curves tend to flatten as the long-run pattern is approached. Ignorance of recent changes partially blocks competitive readjustment of demand, rendering the curve less elastic in the short run than in the long run. Management's ability to increase relatively fixed factors in the long run defers the impact of diminishing returns, thereby tending

to flatten short-run marginal cost curves of successive temporal sections.

The two surfaces intersect in a line curving in three-dimensional space. This line marks optimum output through a succession of adjustments tending toward long-run conditions. However, all this is an essentially "static" view. If dynamic or evolutionary change rather than mere adjustment is contemplated, these surfaces must be regarded as in constant motion. Each new invention, each change in want patterns, each change in patterns of social control will bend and twist and warp the surfaces. Such omnipresent change produces managerial ignorance and uncertainty with respect to present and prospective conditions.

Other difficulties of an accounting and engineering nature arise when a single enterprise manufactures a number of products. Then a management attempting to apply the economic theory of pricing for maximum profit must allocate costs among products. As far as possible this allocation should be made on an incremental or an opportunity basis. If more of one product is produced, what variation will take place in total annual enterprise costs? If certain productive energy were not devoted to this product, where could it be used most advantageously, and what would it be worth in the new use? Again time enters as an important factor, limiting conversion from one use to another and also limiting the rate at which productive resources can be increased or decreased (transferred from or to other enterprises).

Although this theory is a useful background for a management coping with problems of price policy, giving such management an idea of the objective desired and the problem to be solved, evidently a management cannot often arrive at a complete practical solution by such a direct attack on the problem of pricing to secure maximum profit.

### *Minimum Prices*

Another approach to pricing the wares of an enterprise is the determination of minimum prices below which management would rather lose business than accept it. This may take the form of finding the lowest price at which a specific contract should be taken, the minimum price justifying extra-shift or overtime operation, or the lowest price at which production remains more profitable than partial or complete shutdown. From this point of view, business that will bring in revenue in excess of the associated extra costs of producing and distributing will add to the total profit of the enterprise.

The costs and revenues involved are the incremental or opportunity phenomena discussed in Chapter 6. As a general rule, assets acquired prior to the emergence of a problem should be included on a basis of salvage values (opportunity costs), assets to be acquired must be counted at full incremental values (replacement market), and anticipated revenues at conservative sales market estimates. Application of these principles can be illustrated by a short case.

Assume a small company directed by a manager who is at once founder, chief designer, general manager, and star salesman. Such a man often accumulates in his memory all the data gathered by the best of cost systems. His common sense selects, classifies, regroups, analyzes, and interprets this information to best effect. Imagine such a common-sense manager making a bid for a contract job. It offers opportunity to rework spoiled materials otherwise beyond salvage, so he whittles the materials cost. The job threatens overtime on key machines, so he adds appropriate overtime premiums in figuring labor cost. Other machines that could be used are operating below capacity. If he can absorb part of the idle overhead, he will lose less than if these machines continue idle, so he cuts his figure on machine charges. By consolidating purchases for this and other jobs, he can secure additional quantity discounts, so he makes an allowance for cost reductions on other jobs. And so he pieces costs together, logically and with direct reference to his money-making objective. Finally he reaches a minimum price below which he prefers not to take the job. Then in terms of the apparent competition and the evident urgency of his prospective customer's need, he sets a price as much higher as he believes he can get without losing the business to competitors and without sacrificing such important intangibles as the customer's good will.

This approach can be systematized and applied by a larger enterprise, but usually with much less precision. Figures 7 and 8 show cost estimate sheets designed for this purpose. Three price bases are sought: (1) a distress basis for use when operations are well below normal, (2) a normal basis for use when operations are near normal capacity, and (3) an overload basis for use in periods of substantial amounts of overtime operations.

One approach to all three bases begins with compilation of data indicated by the form in Fig. 7. Department and machine numbers are shown as a basis for selecting proper wage and burden rates to apply to the operating hours. Operating hours are found by time studies,

checked by comparisons with other studies of similar operations on other parts and by comparison with production records of the same

Date\_\_\_\_\_

Part Number\_\_\_\_\_

Operation	1	2	3	4	5	6	Total
Department							
Machine number							
Operating hours							
Operating labor cost							
Variable burden on operating time							
Variable operating cost							
Normal burden on operating time							
Normal operating cost							
Setup hours							
Setup labor cost							
Variable burden on setup time							
Variable setup cost							
Normal burden on setup time							
Normal setup cost							

Fig. 7. Form for developing variable and normal costs for setups and operations.

operation on past runs of the same part. Operating labor cost is found by multiplying standard operating times by appropriate wage rates—past average, mid-point of the wage rate of the appropriate occupational classification, etc. Variable burden is the extra out-of-pocket costs associated with operation of the burden center and excluding

direct materials and direct labor. The sum of operating labor cost and variable burden on operating time gives the variable operating cost. Normal burden includes variable burden and also provides for replacements of fixed assets used in the process and for other non-variable items. Normal operating cost is the sum of operating labor cost and normal burden applied on operating time. Setup time is determined and costed in a similar manner.<sup>8</sup>

The total variable setup cost is carried forward to the form shown in Fig. 8. The same figure is entered on line 7 in all four columns. Total variable operating cost is multiplied by the quantities shown in each column heading, and the product entered on line 8 under the appropriate heading. Total normal setup cost is entered in each column on line 10. Since there is but one setup per job, the figure will be constant for all quantities. Sometimes larger runs will justify more elaborate setups, and a larger setup constant will be used for runs exceeding a certain size. Total normal operating cost is multiplied by the quantities shown at the column heads and placed in the respective columns on line 11.

Material descriptions and weights are obtained from the bill of materials for the part. Amounts are multiplied by quantities shown in column headings and by appropriate current market prices. Quantity discounts are reflected in the prices used for the several columns. Costs of purchasing, receiving, storing, issuing, and shipping are reduced to a percentage of materials cost either by use of past averages or of current budgets. If scrap is important, a scrap credit is entered. The totals are found and entered on line 1.

Costs of initial tooling and of engineering design are estimates spread over the initial order and as many subsequent orders as management believes proper. Cost of clerical handling is the sum of factory office and cost accounting costs divided by the number of orders processed—again either past averages or current budget data. This figure is a constant and is entered in all columns of all price basis sheets for all parts. In some enterprises two clerical constants are needed, one for standard repetitive orders involving reissue of filed documents and a larger cost for special orders requiring origination of new routings and schedulings.

<sup>8</sup> Note that the variable operating cost from the total column is added to direct materials cost to find the unit cost for the economic lot size formula. The variable setup cost from the total column is added to clerical costs to obtain a close approximation to the order cost used in the economic lot size formula.

The distress price is the sum of lines 1 to 8. It is an approximation to the out-of-pocket costs that would have to be incurred to pro-

DATE _____				PART No. _____					
				BASE _____					
<b>COST &amp; PRICE ESTIMATE SHEET</b>									
Material Description				Purchase Price		Pcs. Lbs. Per M		Cost of	
				Amt.	Unit			1000 Units	
% Spoilage									
TOTAL									
% Handling Charges									
TOTAL MATERIAL COST & HANDLING CHARGE									
SCRAP	Rough Wt.	Lbs.		Total Scrap Credit per M					
	Finished Wt.	Lbs.		Lbs.	Price				
CREDITS	Boring Scrap	Lbs.							
	Spoilage Scrap	Lbs.							
1. Total Net Material Cost									
2. Initial Tooling									
3. Product Drawings & Tool Design.									
4. Eng. Cost of Tool Changes % of D.L. & Set-Up									
5. Clerical Cost per Order \$ per Shop Order									
6. Totals Line 1, 2, 3, 4, & 5.									
7. Distress Set-Up Cost									
8. Distress Processing Cost									
9. Distress Price Cost									
10. Normal Set-Up Cost									
11. Normal Processing Cost									
12. Normal Manufacturing Cost									
13. Margin for Administrative, Selling, & Development Engineering Expense									
14. % Profit									
15. Normal Price Basis									
Additional Cost for Jobs Requiring Overtime									
16. 50% Set-Up Labor									
17. 50% Processing Labor									
18. 50% Tool Room Labor									
19. Overload Price Basis									
Established Selling Price \$									

FIG. 8. Form for building costs to serve as basis for preparing quotations and estimating prices.

duce an additional quantity of the part. The several columns give effect to (1) quantity discounts and (2) the constant elements of setup, clerical cost, tooling, and design.

The normal price basis is the sum of lines 6, 10, 11, 12, 13, and 14. It is an approximation of long-run average cost including all elements involved in the distress price basis and providing for replacement of fixed assets and for recapture of equitable portions of general organizational expenses. The peak load price basis is the sum of the normal price basis and lines 16, 17, and 18. It adds in overtime premiums to arrive at an approximation of incremental costs in peak periods of operation.

Managerial judgment will be required in adjusting these data for special facts not caught by the accounting record, in giving effect to intangibles, and in selecting the basis to use under any given operating conditions. The full logic of minimum prices based on covering short-run incremental costs applies

1. When a company is struggling to maintain short-run solvency. Cash is needed to meet maturing debts, and sales are made when they bring in more cash than they take out—both receipts and disbursements being in terms of the immediate future. This is the price approximated by the distress price basis discussed above.

2. When sales are strictly independent, *i.e.*, in separate markets both as to customers and as to time. If cutting prices to one customer influences prices obtainable from another, such ramifications must be considered. If lowering or raising prices now will influence future sales through changes in customers' inventory policies, *e.g.*, stocking up, these changes must be taken into account. Companies making special items to order have very nearly ideal conditions for pricing to recover (at least) the short-run outlay necessitated by each order accepted. In trough periods, such pricing recovers some of the fixed burden instead of losing sales and absorbing none of the costs of idle time. In such periods, the distress price basis would be appropriate. In peak periods, such pricing forces each job to carry the full marginal costs, including labor at overtime and overhead at a rate fixed by the cost of further expansion. The peak load price basis of Fig. 8 is an approximation to such pricing.

3. In periods of great uncertainty. Impending obsolescence or great changes in social structure may render markets so chaotic as to eliminate the usual interplay of prices, and long-run calculations may become entirely meaningless.

### *Successive Pricing Goals*

Another approach to managerial pricing sets up a series of goals. These goals follow different successions under trough and peak operat-



ing conditions. Assuming a company operating under off-peak conditions, the lowest goal is a price that will cover out-of-pocket costs, a price that will allow the company to get as many dollars for an order or for an increment of output as it must lay out. Business taken below this point will reduce the total profit (or increase the loss) of the period. If such business be taken at all, either management has made a mistake or there are powerful offsetting intangibles.<sup>9</sup> Orders taken above this price will absorb some overhead and will pay unless intangible losses offset the tangible immediate cash gain; *e.g.*, the price charged may affect the prices obtainable on other orders.

The next goal for a company operating well below normal output is a price that covers "standard" costs, including normal overhead. At this price level, the company will make profits if business conditions permit output to expand beyond normal levels. However, if attainment of this pricing goal causes volume to fall faster than price rises, the total profit picture may prove less attractive than more volume at a lower price permitting absorption of more actual burden.

The next goal would be an increase in price or in volume that would cause total income to cover total long-run cost (the cash break-even price covers total short-run incremental cost). At this price, the company can stay in business permanently, replacing fixed investment items as they wear out. This price need not return interest on owned capital. In many modern corporations, stockholders are a dispersed, unorganized group unable to prevent replacement of fixed investment once original costs are recovered in the prices obtained. "Cash break-even" can be estimated in terms of any length of run, usually being restricted to short-run calculations and reducing to the goal of price covering total cost (including burden but not interest on owned capital) in a long-run perspective.

Higher prices without corresponding diminution of volume will produce a return on capital investment. Management may set many profit levels as successive indications of achievement. Critical among these is the level at which rate of return on investment becomes high enough to enable management to obtain additional voluntary investment.

Where style requires production of a variety of patterns, *e.g.*, coffee tables, decisions must be made as to when a pattern should be discontinued in favor of a new pattern. Here a "satisfactory" price

<sup>9</sup>In 1933 some companies fought strenuously for business far below the "minimum" level in an attempt to prevent competitors from "stealing" their old customers.

must be established, and a "satisfactory" volume set. When price must be cut below satisfactory to maintain the satisfactory volume, the pattern should be supplanted by a new design. For this purpose, management may want all costs allocated to patterns, for somehow management must get prices sufficiently high to recover all costs. Perhaps the customary arbitrary methods of traditional cost accounting will prove as satisfactory for this purpose as any other method.

If the company is operating at peak load, the succession of these goals is altered. The lowest goal becomes one of covering total cost by total income. (There seems to be no reason for an enterprise to strain capacity and operate at very high marginal costs while losing money.) Next is covering standard costs. These, being based on "normal output," will result in "overabsorbed burden" and profits. Short-run cash break-even on the marginal unit tends to be still higher, including overtime wage rates and rapidly increasing marginal costs due to the impact of diminishing returns. Short-run cash break-even is definitely a marginal concept, running in terms of balancing incremental revenue against incremental cash outlays.

If dealing with independent sales and operating at peak load, logically a company would insist on reaching the highest of these goals. Accepting business at any lower price would actually reduce total annual profit, for the highest goal described merely requires recapture in price of what could be saved by not taking marginal business. Consequently, prices lower than incremental cash outlays are rational only if these prices are interrelated with other prices. For example, a company may take an order that will reduce its annual profit in order to maintain customer good will. At some future time the company may not be operating at peak load and may need repeat business at mutually acceptable prices, established through a long history of serving the customer.

### *Discrimination*

Different customers are charged different prices. Some of these differences are based on differences in cost of serving; others on differences in demand curves of separable customer groups. In neither is the adjustment exact; since facts are not precisely known, there is much room for differences of judgment and for prejudice. Among price differences at least partially based on cost differences are the following:

*Quantity discounts.* There are costs that vary with the number of orders and not with the total quantity sold, *e.g.*, sales salaries and

traveling expenses, credit granting and collecting, order writing and billing, accounts receivable bookkeeping, production planning and control, cost keeping, and handling receipts. This condition tends toward one of several types of quantity discount. Perhaps most common and one of the less desirable is the quoting of different prices per pound or per unit for different quantities. A better (because it follows the cost pattern more closely) device is the block pricing system much used by utilities, each successive block taking a smaller price. Perhaps most closely following the behavior of costs is the method occasionally practiced of making a fixed service charge, plus a charge per unit sold.<sup>10</sup> A less worthy variant is the minimum charge or minimum order.

*Annual discounts.* Such discounts are frequently used for "strategic" purposes: to block out competitors and establish a zone of restricted competition. This practice is objectionable. However, there are costs that vary with the number of customers, and reflecting such cost differences in prices charged is not wholly reprehensible. Such costs may be costs of direct-mail advertising, part of sales salaries and traveling expenses, and part of accounts receivable bookkeeping. Sometimes a company attempts the same end by reflecting such cost differences in the commission paid (on the plea that some sales should be discouraged as undesirable) or by formulating sales plans to avoid attempts to sell small annual volume accounts. Of course, such methods can also be employed in handling the problem of small orders.

*Financial terms.* There is a considerable difference in costs between cash and credit business and substantial variation with the length of credit extended. Such variables include cost of investigation and extension of credit, costs of bookkeeping, interest, and costs of collection and losses from bad debts. Some companies quote a lower price on cash business, and substantially all make carrying charges on installment sales. Some give a further discount for cash with the order, reflecting cost differences in interest and in troubles arising from cancellations of orders and perhaps reflecting the poor working capital position of the seller.

*Delivery.* Many companies sell f.o.b. factory. Others sell f.o.b. delivery point but include delivery costs in figuring price quotations. Others quote zone prices that roughly reflect delivery costs. Many maintain a uniform price over the entire market—a practice that appears economically (socially) undesirable.

<sup>10</sup> Some watch-repair services make a fixed charge of \$2.50 "for cleaning" plus time and materials for repair work.

*Method of sale.* Some companies reflect differences in selling and service costs in the prices of goods sold through different channels, especially as between mail-order business and business secured through distributors, salesmen, or retail outlets.<sup>11</sup>

*Off-peak business.* Peaks may be diurnal, weekly, monthly, seasonal, cultural, or cyclical. Off-peak business of all varieties may be encouraged by price concessions or by penalties on peak business: nighttime water-heating electric rates, daytime movie prices, pre-season and postseason sales, and perhaps the price swings of the business cycle. Such price discriminations imperfectly reflect cost differences, the peak price reflecting capacity as well as operating costs. It seems socially desirable that much more attention be given to pricing to reflect capacity costs at the peak and to encourage buying in the trough.

Price discrimination based on demand differences are less likely to be socially desirable and often appear based on prejudice or custom rather than on rational enterprise self-interest. Some appear justified from a management viewpoint; almost all are traceable to monopolistic elements plus the technical ability to segregate customer groups. Examples of such discrimination are (1) high prices on books and motion pictures when first issued, followed by successive price reductions to tap groups of lesser purchasing power or less avid desire; (2) differences in industrial and domestic electric rates; (3) the entire system of product classification employed by railroads; and (4) differences in prices charged wholesalers, retailers, and consumers on identical quantities of identical goods.

One should be wary of leaping to the conclusion that all such discriminations based on demand differences are socially undesirable or reprehensible. It is certainly mathematically possible for a situation to exist wherein a seller can obtain sufficient revenue by such practices to enable him to engage profitably in satisfying a want but could not do so were he required either to charge uniform prices or to base all discriminations on actual cost differences. This is probably true of the railroads. If they were to attempt a uniform ton-mile charge plus charges for terminal handling plus charges for special handling or services rendered for some commodities (refrigeration, speed, protection from damage), they might lose sufficient bulk business to con-

<sup>11</sup> Sears, Roebuck charged 10 per cent less for an electric mangle sold by mail order as against one sold through their retail store. The mail-order purchase involved a 10-day wait for delivery and a small amount of simple setup after delivery.

centrate their overhead costs on progressively smaller volumes, with consequent increases of costs and prices, until they actually ceased operations. This argument not only supports price discriminations based on demand differences (charging what the market will bear) but also supports permitting limited monopolies under certain circumstances.

Many discriminations are frankly opportunistic and tend to be socially undesirable. These practices may sometimes be mistakes arising in prejudices or customs of entrepreneurs. Sometimes they are practices desirable from the point of view of the enterprise and less frequently defensible from a broad social point of view. Such practices include taking advantage of carelessness or ignorance of buyers, trading on friendship or kinship, and combining need with ability to pay, *e.g.*, medical custom. It should be noted that such discriminations may enable an enterprise to exist and satisfy demands at prices each buyer is willing to pay when such an enterprise could not maintain itself otherwise.<sup>12</sup> Here again, the argument supplies some support for discrimination on the basis of differences in demand and some support for permission of limited monopolies.

### *Intangibles*

Here, as with other problems of managerial planning, intangibles are often of dominating importance. Companies may feel compelled to provide full lines because customers prefer to buy certain items from a single source or because conditions at the point of resale make full lines imperative, *e.g.*, branded hosiery. Some companies believe themselves operating in a field of customary prices.<sup>13</sup> Certainly experience has shown a tendency for some commodities to move better at certain prices than at somewhat higher or lower prices. Many discussions of monopoly price mention potential competition as a factor in price policy. With the general explicit recognition of product differentiation and the development of the theory of monopolistic competition, potential entrants are recognized as more nearly universal price-determining factors. Finally, managements are somewhat reluctant to change prices for fear of spoiling markets. Customers may hold off buying in anticipation of further reductions. Or if prices are raised, customers may hold off buying because prices appear un-

<sup>12</sup> Medicine, especially hospitalization, may be a whole industry in such a predicament. This problem is an important factor in the argument over private vs. public medical care.

<sup>13</sup> Some candy bars are notorious for varying in weight rather than price.

naturally high and likely to return to former lower levels. Of course, both concepts can act in reverse, buying on rises in anticipation of further rises or on decreases because prices seem unnaturally low. The matter of fear of spoiling markets appears to be wholly short run; whereas the other factors mentioned may persist indefinitely.

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## CHAPTER 10

### MANAGERIAL CONTROL

Purposes of chapter: to investigate the need for managerial control, its scope, and its processes and to note the role of participation by the controllee.

Management formulates and compares rival plans of action and selects the most attractive program, *i.e.*, that which enables fullest satisfaction of all pressure groups. It remains necessary to compel events to conform to the program chosen. Plans are not self-achieving. People must be brought to act in accordance with the program to bring it to fruition. Management's job is only half done when an acceptable program has been formulated. Subordinates must be instructed, directed, motivated, inspected, and corrected until the program works and its objectives are attained. This is the purpose and content of managerial control.

#### SCOPE OF MANAGERIAL CONTROL

Managerial planning seeks a consistent, integrated, and articulated program. Since managerial control seeks to compel events to conform to plans, it must exhibit the same structure of interrelationships and of timing. A complex program of managerial plans may fail in some particulars. The control system should report such failures and should contain sufficient elements of flexibility to maintain managerial control of operations in spite of such failures. For example, sales volume may deviate from plan, but a flexible budget continues to control expenses in terms of volume achieved as well as volume planned. Again, production may be planned in terms of anticipated sales volume, but the control system may provide superimposed stock limits. If shipments run ahead of expectations, inventories are prematurely depleted, the control system reports items running dangerously low, and schedules based on sales expectations are revised accordingly.

The structure of managerial control also reflects the organizational pattern of the enterprise. Responsibilities of individual employees of a group are cumulated, sometimes with necessary adjustments, to

ascertain the responsibility of the group leader. Responsibilities of component groups are similarly cumulated to find the responsibility of a division manager. And so on up to the final grand aggregate, which shows the responsibility of the chief executive.

The responsibility of each employee, of each group leader, of each divisional manager, of each departmental chief is threefold. Each is responsible for an achievement, for accomplishing some task. Each is responsible for expenses incurred in the process of accomplishing the task. And each is responsible for equipment or other assets or resources used while performing the assigned task.

#### *Problems of Control of Achievement*

Each department, each division, each section, and each individual is assigned tasks to perform. The organizational pattern defines the interrelationships and jurisdictions of these operational units. Chapter 3 discussed the various forms this pattern might take and outlined a functional organization, the elements of which can be found in virtually all manufacturing enterprises at one level or another. Each functional group or subgroup was described in terms of the tasks assigned it, of the achievements expected of it. Chapter 5, in the course of a discussion of Standards of Achievement, followed the responsibility classification and carried the analysis into sufficient detail to make unnecessary further elaboration in that direction here.

#### *Problems of Control of Costs*

Each achievement has its cost. For effective managerial control, cost standards by which performances are judged, as well as achievement standards and performance data, must be gathered into a hierarchy of subtotals and totals precisely paralleling the organizational pattern. Each operator, each section chief, each divisional manager, and each department head should have predetermined cost allowances as well as achievement quotas covering all aspects of all activities for which he is responsible. Sales quotas are paralleled by allowances for salaries, commissions, traveling expenses, telephone, printing, postage, and other sales aids. Research achievement cannot be evaluated save by comparison with its cost. If production schedules are maintained at prohibitive costs, the achievement is of little value. Many planning and control systems work beautifully but are discarded because of excessive clerical costs.

Managerial control of costs requires flexible standards stated as functions of achievements. Actual work loads may vary widely from



those planned. For example, a factory may produce more than was planned because the sales department sold more than it was expected to do. Or the type of volume sold may require much larger numbers of much smaller orders than was anticipated. Cost budgets should be adjusted for such variations before comparison is made with actual costs. Actual costs should be judged in terms of actual accomplishment.

Variation in achievement is not adequately measured by over-all variations in sales volume. There are other dimensions to the control problem. Sales volume for a period may be smaller than expected but may be spread over more orders than was expected. The result may be altogether unsatisfactory from a profit point of view. Yet clerical departments that exceed their budgeted expenses may be efficient. The volume of clerical work depends more on number of orders than on total sales volume and may more than justify the expense incurred. Furthermore, if the clerical staff has been organized to handle the smaller number of orders expected, the larger number experienced may not only require more clerical hours (real costs), but these hours may necessarily be overtime hours at premium wage rates. Thus, real costs may exceed those planned by management, and exchange costs may prove even more excessive; yet expense budgets may require such substantial adjustment for work loads as to prove the performance to have been conducted efficiently.

The principle of flexibility in cost standards applies to control of materials costs. If more units of product are produced, budgeted allowances of real costs, *e.g.*, pounds of raw material, should be adjusted, usually in direct proportion. The budget of exchange costs may require a similar proportional adjustment, or changes in quantity discounts may require nonproportional adjustments.

The budget of direct labor cost by means of which departmental operations are judged should contain elements of flexibility. Planned hours should be adjusted, usually in direct proportion, for deviations in actual output from that planned. And wages paid may require further nonproportional adjustments for changes in proportion of overtime hours to total hours necessitated by the deviation in output from that planned.

Service departments use materials, labor, and capital to provide benefits for other departments. These benefits are achievements of the service-rendering departments and are real costs of the service-receiving department. The extent of benefits will largely determine

the necessary minimums of service department's costs. Consequently, demands of other departments for services must be brought under control. For example, the plant division of the manufacturing department uses coal, water, and power (real costs) to supply process steam to a processing department. The processing department is responsible for amount, temperature, and pressure of steam required. The service department is responsible for amount and quality of coal, water, and power used to supply the steam. And the purchasing department is responsible for the price paid for the coal.

Investment charges are somewhat similar to service department costs. The department using capital is responsible for kind and amount of capital used, but not for the costs of procuring or supplying this capital. The purchasing department is again responsible for prices paid to other social units. The maintenance department is responsible for costs of installation and sometimes of construction. And the finance department is responsible for interest costs, insurance charges, and tax burdens.

### *Problems of Control of Investment*

Each achievement has its cost, and nearly all require use of capital. Individuals must be made responsible for use of capital as well as for incurrence of cost and achievement of partial objectives. If any investment item becomes too large, carrying charges make costs unnecessarily high: insurance, taxes, interest, maintenance, deterioration, and obsolescence become excessive. If any investment becomes too small, inadequacies force costs up. Idle machines and labor are caused by lack of materials, bottlenecks in equipment, or congested production areas. Broken lots are put through to complete customer orders or to avoid partial shutdowns. Broken lots cause increased setup and clerical costs and tend toward general confusion and loss of managerial control.

Recently a sales department was bitterly critical of factory delivery promises and performances. The situation was obscured by shifting proportions among a variety of products and by a substantial addition to factory floor space. When shipments were reduced to a standard hour basis and total standard hours shipped were divided by available square feet of floor space, a persistent trend toward larger outputs per square-foot hour was disclosed. Inadequate floor space rather than inefficient factory operations was proved responsible for unsatisfactory deliveries.

## PROCESSES OF MANAGERIAL CONTROL

Control of achievement, costs, and investment are three aspects of the problem of control of activities of subordinates. A method or process is needed whereby higher organizational levels can direct and control the achievements, costs, and capital utilization of lower levels. Plans are formulated in accordance with the principles and processes discussed in Chapters 4 through 9. These plans must be recast into standards of individual performances. The plans must be effectively communicated in the form of directions to persons on lower organizational levels, informing each of the tasks he is expected to accomplish and of expense and investment limitations imposed. Some form of motivation is required, usually financial, supplemented by praise and criticism and by various nonfinancial rewards and penalties. Different aspects of the resulting performances must be reviewed and compared with the standards; and where performance is judged inadequate, remedial action must be undertaken.

*Standards of Individual Performance*

As we have seen, these standards may be classified as standards of achievement, of costs, and of investment. They may also be classified as physical, temporal, or financial. For example, standards of manufacturing achievement may be physical, stating quantities and qualities of product to be produced in a given period. They may be temporal; *i.e.*, a schedule may be devised showing when each process on each item produced should be performed. Or they may be financial, stating dollar values of product planned for a given period. Cost standards may also be physical, temporal, or financial. A standard cost of 3 hours per unit may be set on a particular operation on a given part, or a machine may be reserved for a specific 3-hour period to accomplish this task, or the cost may be estimated in terms of wages to be paid. Similarly, investment standards may be physical, temporal, or financial. Inventories and equipment permitted each employee may be physically catalogued. Often many employees use the same equipment, and its availability must be scheduled. Larger organizational units, such as branch plants, may be limited as to total dollar value invested in inventories or fixed assets.

Chapter 8, on the Techniques of Managerial Planning, outlined a technique for describing and comparing alternate courses of action. Details of the selected plan often include many standards needed for managerial control. However, these detailed standards must be re-

classified according to personnel responsible for performance. Thus the specifications and bills of material discussed in Chapter 5 become standards of performance against which the work of the purchasing department can be judged. Time standards, evolved from motion and time studies and used in selecting the most desirable product designs and the most efficient resources, now become standards of performance used for judging the efficiency of factory operations. Burden estimates associated with the selected plan are reclassified according to individual responsibilities and form a basis for judging corresponding aspects of execution. These "building blocks of planning" are regrouped according to personal responsibilities and thus become standards of performance basic to managerial control.

At higher organizational levels this detail becomes unmanageably voluminous. The general manager of even a small enterprise cannot afford time to review each minor operation, to compare standard with performance for each day of each employee's time, to investigate all significant deviations, and to initiate the required remedial action. He must delegate the details of control as well as the details of planning. And he must be able to govern the performance of the lesser executives to whom the task of controlling details of performance has been delegated. Somehow the detailed standards and performances must be gathered into a hierarchy of totals or indexes paralleling the organizational pattern. Heterogeneous detailed physical standards of achievement or of real costs must be consolidated into the required pattern of standards or indexes against which performance of every individual at every organizational level may be judged. For example, each foreman controls spoilage and waste of materials by operators day by day, operation by operation. Total spoilage and waste, in tons or in dollars, are found for each department and measured against standards to give the superintendent control of the foremen. To introduce an element of flexibility, both standard and performance are often stated as a yield, *i.e.*, as a percentage of total production. Similarly, detailed labor standards and performances, either in hours or in dollars, are cumulated into departmental totals.

Tonnage, hours, or dollars may prove appropriate common denominators for constructing such patterns of standards. Usually they are more or less deficient. One ton or one hour may differ in importance or significance from another. A ton of brass represents much more value than a ton of cast iron. A secretary may justifiably spend a whole day to save a single hour of her boss's time. Nor is a universal use of dollar values sufficient. Financial data may lose much that is

significant in the physical data. The importance to the enterprise of physical accomplishment and physical cost is measured at the margin—the financial aspect is always an incremental or an opportunity measurement applied to the physical phenomena. For managerial control, a further factor must be considered, the opportunity of the controllee to influence the task accomplished or its cost. This factor plays a subsidiary role in the processes of managerial choice but becomes perhaps the dominant factor in the process of control.

### *Directing Subordinates*

Management must somehow communicate its plans to those who are to execute them. On the more primitive levels, communication takes the form of telling or showing, and “standards” tend to be subjective—something the supervisor “knows.” Taylor and his disciples insisted upon formal, recorded standards and written instructions based thereon.<sup>1</sup> The formulation of standards and instructions was conceived as a function of management. Traditional and variable rules of thumb, the trade mysteries of skilled workmen, were to be supplanted by scientifically devised standards communicated in writing to all appropriate personnel.

Dimensional standards are transmitted on blueprints to production workers to direct them in their processing activities. Standard-practice instructions may also be issued to tell them what tools and fixtures to use, what sequence of motions is most effective, and how much time is allowed for the work. Shop orders accompany drawings and standard-practice instructions to tell the operator the number of units to be produced and to give much of the identification data needed for proper preparation of time tickets, inspection reports, etc.

Standard-practice instructions may also be issued to direct clerical workers and first-line supervisors in the performance of virtually all repetitive tasks. Bookkeeping-machine operators are so instructed in the posting of accounts receivable records. Messenger girls are similarly instructed in mail routes and pickup and delivery times. Foremen are directed by standard-practice instructions in proper preparation of merit-rating reports, in handling absenteeism, or in instructing new employees in their tasks.

<sup>1</sup> Business houses are full of memorandum pads with printed captions, “Verbal Orders Don’t Go.” Most orders require the use of words! Executives, reputed to have a larger vocabulary than any other vocational group, should avoid confusing “verbal” with “oral.”

Schedules and budgets are issued telling foremen and superintendent what must be accomplished and within what limits the tasks must be accomplished. Similar schedules and budgets are issued governing the activities of virtually all service departments. The purchasing department is informed of quantities and qualities of items required, the dates they will be needed, and the allowable expenses for the operation of the purchasing department. Usually directions as to cost limitations are explicit, definite, and unmistakable. Directions as to tasks to be performed, especially by overhead departments, are more likely to be vague or implicit. Often the performance side is implicit in rather general statements of policy. These should at least be written to gain as much definition as possible. They are often merely traditions—followings of more or less clearly remembered precedents.

### *Motivating Personnel*

Direction is not enough. Issuing instructions does not secure compliance with plans even though the instructions are thoroughly understood. Employees must be persuaded to exert effort, to try to carry out instructions. Coercive methods have been common in human history but are excluded by the premises stated in Chapter 3. Fear of discharge has been a major incentive since the wage system began. Piece rates are perhaps equally venerable. The scientific-management school erupted incentive wage systems in utmost profusion.<sup>2</sup> These tie remuneration directly to performance.

Much depends upon how an incentive wage plan is handled and upon outside influences impinging upon it. Many unions frown on all incentive plans; virtually all object to gain-sharing plans. Straight piecework, even with guaranteed day rates, may prove objectionable because it excludes merit differences based on seniority, versatility, dependability, etc. Therein lies the great merit of the 100 per cent Halsey plan, in which each workman is paid his regular hourly rate multiplied by his standard hours of output. Placing pay-roll computations on a daily output basis instead of a job-by-job basis reduces the opportunity and temptation to cheat by juggling reported times. Where cost is overwhelmingly direct labor cost with little reduction in overhead possible, a fractional Halsey plan, say straight time plus 75 per cent of the excess of standard over actual time, pro-

<sup>2</sup> C. W. Lytle, *Wage Incentive Methods*, The Ronald Press Company, New York, 1944.

vides a saving out of which extra clerical costs and supervisory bonuses may be paid. Where an individual's output is dependent upon others of a small group working together, the Halsey or virtually any other plan may prove more effective on a group basis.

Whatever the features of the plan selected, every phase of the plan should be explained, the reasons for each feature set forth in full, and the plan sold repeatedly to the men and their representatives. Standards must be fair and consistent, the latter more important than the former. They should be subject to review by employees' representatives and guaranteed for a definite time unless bona fide changes in methods or product design render performance standards obsolete. Incentive plans are poor substitutes for vigilant supervision. Unless managers maintain standard conditions, any incentive plan may cause endless grievances.

A milder variation is the "measured day work" plan. The same standards are set, performance is measured in the same manner as for any of the direct incentive systems, and the results are incorporated in a permanent record of accomplishment, which is used to guide management in making promotions, merit increases in hourly rates, and layoffs. Mere knowledge of the existence of such a record is a powerful motivation.

Intangible incentives may be utilized. A teacher or an administrator tells an investigator that a chapter in his latest report is one of the best he has written, now if he can only make some other chapter as good. . . . A football coach or a sales manager exhorts his charges to exert utmost effort for the honor, prestige, and reputation of the school or of the company—that's the old team spirit. Individual or group records are posted for public acclaim or disapproval. All powerful motivating devices must be used with care. A foreman posted a list of the six employees in his department who had "contributed most to the war effort" by exceeding standard outputs. A strike resulted because other employees felt that the list tended to proclaim them as "slackers."

### *Inspecting Performance*

Motivation is increased by prompt inspection of results. If each employee knows that his work will be promptly inspected and critically appraised, that his superiors will know about and appreciate work well done, he will exert more effort than if he believes no one knows and no one cares.

Motivation results in performance of some kind. Before managerial control is effective, the performance must conform to the plan. Inspection is the process of ascertaining the degree of conformance achieved. What was accomplished? How does performance compare with the plan, *i.e.*, standards and instructions? Precisely where and in what respects has performance deviated from plan? Who was responsible for (caused or permitted) the deviation?

Much of this inspection has always been personal; the man in authority inspects by direct evidence of his own sensory organs. The general parades his troops or observes field exercises. A good shop superintendent spends most of his time prowling around the factory, keeping in touch with physical reality, sharpening his ability to evaluate and interpret data and to appraise intangible factors. A good accounting system extends the power of the executive by reporting masses of data beyond the range of any one man's perceptual powers. These data must be organized and evaluated, or they too will exceed the executive's grasp. This is accomplished by building data into a structure paralleling the organizational configuration and by matching performance data with plans. In place of exclusive reliance on direct sensory inspection, the executive relies increasingly on reports comparing plans and performance. Then he inspects personally or vicariously the physical realities reflected in the deviations.

Much of the story of control is a matter of promptness. Effective control requires immediate and frequent follow-up. Policing must be done at the source to achieve greatest effectiveness. "At the source" means proximately: geographically, temporally, functionally, and personally. Inspection and correction should be as soon after (or even during!) an act as possible. It is most effective at the place of action, surrounded by the conditions under which the act was performed and the deviations from plan occurred.

### *Remedial Action*

Since management of a large establishment cannot follow every detail so immediately, the job is delegated to the system of standards, records, and reports. Deviations of performance from standard are investigated and reported to appropriate executives. For example, follow-up men investigate reported deviations from shop schedules. They report minor deviations and causes to foremen who typically have authority to transfer personnel within the department or to operate overtime in order to restore operations to schedule. A report of deviation, cause, and remedy may be made to the superintendent



for review of foreman's performance. Sometimes follow-up man or foreman will report the deviation and recommend action beyond their own jurisdiction. Investigation may disclose faulty plans, inadequate facilities, defective materials, or impotent personnel. Faulty plans can be reviewed and revised. Inadequate machinery or equipment can be replaced, repaired, or supplemented; work can be contracted out; or equipment worked overtime. Defective materials may be salvaged or replaced, purchasing specifications may be found to need revision, or receiving room inspection procedures may need improvement. Having explored and corrected conditions pertaining to plans, materials, and equipment, a continuing history of failure indicates inadequacy of personnel. Personnel may need disciplining, additional training, better supervision and motivation, transfer to more appropriate positions, or replacement. Conversely, a personal history of success suggests promotion and increased compensation.

Direct labor time for an operation may significantly exceed the standard. The system of standards, records, and reports promptly informs the relevant foreman. He immediately investigates. He may find that the operator or setup man needs additional training, better motivation, or discipline within the foreman's own competence. He may find materials defective, which should be reported to inspection for remedial action looking toward prevention of repetition and toward such salvage as may be possible. Perhaps the foreman will believe the standard itself in error and request a check by the time-study department. He may find equipment defective and call upon maintenance for remedial action. If machinery proves inadequate, he may request extra-shift operation, additional machinery, or sub-contracting of some items.

Similarly, the system of standards, records, and reports may report expenditures in excess of budgets. Always it reports the *exception* to the manager, the event that deviates from plan or standard. This gives the manager a starting place for expeditious and effective investigation of causes. A pattern of deviations may even suggest remedies. Tabulation of failures classified by machine number, by operator's clock number, by supervisor, by kind of material, etc., may disclose a common cause and practically reveal the correct solution. Failure to discover and apply a remedy, usually disclosed by repeated failure appearing in tabulations or summaries, results in reporting to higher levels in the administrative hierarchy. Higher managers ask lower for an explanation, for a report of action taken, or for a suggestion if the remedy exceeds the authority vested in the lower man-

ager. The superior checks answers as far as possible against facts and opinions of other employees and in his turn attempts remedial action. And so on up the administrative hierarchy until the problem is solved and the remedy found.

#### EMPLOYEE PARTICIPATION IN PLANNING AND CONTROL

Employee participation in planning and control is tending to become compulsory. A major trend of these times is toward liberalizing industrial and economic life. The concepts and ideals of liberal democracy are being carried over from the political to the economic and industrial realm. "Managerial prerogatives" are giving way to labor-management cooperation on what have hitherto been regarded as problems for managerial decision.

Managerial decision and action are retarded but improved by employee participation. Many plans are improved by employees' contribution of new viewpoints and more concrete contact with multitudes of detailed facts. Standards become more accurate and realistic when subjected to careful review by those charged with putting them into effect. Participation in formulating plans and establishing standards compels thinking jobs through and relating jobs to their context, which bring greater understanding and a flood of suggestions. Finally, participation in planning action and in reviewing the consequences of action has been found one of the most powerful of motivating forces.

A liberal democracy is characterized by (1) the rule of law instead of the rule of men, (2) government with the consent of the governed, and (3) checks by the governed upon the compliance of the executive with the rules. The modern trend is to abhor arbitrary government to the point of violent opposition to the mere semblance of arbitrariness. Paternalism is rejected as the arbitrary action of a benevolent despot. Labor fights to secure its rights in the law of the land and in contracts resulting from free bargaining among equals. It insists that its perquisites be recognized as rights rather than as boons granted by an omniscient, benevolent management.

The processes by which these ends are sought are (1) participation by labor in establishing the rules governing the employment relationship, and (2) a continuous review by labor of the manner in which management administers these rules.

#### *Participation in Managerial Planning*

Management is learning to seek the enthusiastic cooperation of labor in carrying out the plans of the enterprise, and it is learning that the

surest means to whole-hearted cooperation is the admittance of labor to partnership in the evolution of these plans. A series of examples can best illustrate how participation in establishing the rules works out in practice.

A management comes to believe in the desirability of an equitable wage structure founded on comprehensive job evaluation. Job evaluation is not now and probably can never be a science. It involves setting pecuniary values on collections of heterogeneous incommensurates. It is full of judgments rather than measurements. At best it is a fragment of industrial democracy, a substitution of a rule of jointly devised law for snap judgments by management. It seeks to eliminate inequities growing out of idiosyncrasies of foremen and department heads. It seeks a wage structure reflecting job facts and a consensus of value judgments.

One successful approach is a compilation of job descriptions and analyses by management reviewed by labor, followed by classification into labor grades by management again reviewed by labor, and terminated by collective bargaining on wage rates assigned to each labor grade. Typically personnel manager, methods man, superintendent, and foreman describe and analyze each job in a department, first stating what the job incumbent does and then analyzing the activity to discover implications as to knowledge, judgment, and skill required. A typical description and analysis is exhibited on page 110. These descriptions and analyses are reviewed by shop stewards and operators. Such review invariably results in many corrections, which greatly improve accuracy and completeness. Personnel manager, superintendent, and methods man (or consulting engineer) then sort the descriptions into groups reflecting their judgments in terms of the knowledge, judgment, skill, etc., content of the various jobs. The resulting classification of jobs into labor grades is reviewed by stewards and business agents, and further discussion with management's representatives usually results in some adjustment and general acceptance. Minimum rates for jobs (and for corresponding grades) most comparable among the plants of a community are set by collective bargaining. This usually enables agreement on steps between labor grades and ranges from minimum to maximum for each grade. Finally management assigns each employee to a job (and consequently to a labor grade), stewards and employees review the assignments, and objections are carried through the regular grievance machinery. This method has the enormous advantage of being so simple that every employee can understand its every detail. There can be no possibility of an em-

ployee's feeling befuddled, browbeaten, or railroaded into accepting something he does not quite understand.

Methods work has been conceived as a function of management—a scientific management replacing the “trade mysteries” of skilled craftsmen by written standard-practice instructions derived from scientific research into methods. This concept is gradually being replaced by an approach to methods work through training foremen and operatives in the principles of motion economy and encouraging these people to originate improvements.<sup>3</sup> This spreads the impact (and the cost) of highly trained methods engineers over a wider area and so produces swifter results. It also results in powerful motivation, as operators derive enthusiasm and drive from the creative activity involved. They must prove that the methods they have invented are vast improvements!

Surprisingly little effort is required to start a renaissance in methods. The typical plant is still virtually virgin territory for the motion enthusiast. The methods engineer is introduced to a meeting of foremen. He presents the story of greater output with less effort. He illustrates his story with “before and after” motion pictures showing the use of drop deliveries, foot-operated fixtures, applications of power screw drivers and wrenches, bin setups for convenient arrangement of materials, balanced hand motions, and other wrinkles of the methods man. He may bring in materials and stage a race between a skilled assembler using traditional methods and a neophyte using methods developed by motion study. After sufficient dramatization to secure interest and generate some appreciation of motion economy, volunteers are sought to present a current operation and a suggested improvement for a subsequent meeting. After such a presentation, criticisms and further suggestions are requested, more motion pictures illustrating “principles” are shown, and more volunteers selected to present new applications at the next meeting. Soon the program is rolling among the foremen and new groups are formed—of shop stewards, of key operators, of supervisors, of anyone really interested. Properly handled, here is another fragment of industrial democracy in action. New standard practices are evolved with full participation by all, resulting in understanding and acceptance of these new rules by those governed thereby.

As indicated in the studies of planning and control, standard times

<sup>3</sup> Mogenson and Dutton in particular have preached this approach to methods work. See Mogenson, *Common Sense Applied to Motion and Time Study*, McGraw-Hill Book Company, Inc., New York, 1932.

are fundamental elements of both. From the creation of new methods, employee training naturally continues into the realm of time study. The managerial need for standard times as a basis for selecting the best from among a multitude of alternative plans, for predicting shipping dates, for ascertaining plant capacity, and for determining the relative values of operators is explained. The technique of time study is reviewed with special reference to leveling factors for operators' skill and effort and to allowances for tool attention, fatigue, personal needs, etc. Finally machinery is established for settling grievances by review of protested standards by union time study engineers. Once a body of standards has been accepted, they serve as precedents. Company and union time study men must strive to make new standards for new operations equitable as compared with the old. If new standards are looser, employees on old jobs will press for reassignment to the new and management and union will both be embarrassed by the resulting dissatisfaction, grievances, increased turnover, lowered morale, etc. Standards set by a management following known rules and subject to review by representatives of the employees achieve an acceptance making for better labor relations and greater willingness to exert effort.

Indexes of achievements and budgets of costs are similarly subjects for cooperative studies by controller and controllee.<sup>4</sup> Mutual development forces each to consider all aspects and relationships of the contemplated program. This leads to better planning and more complete understanding of plans. Cooperative planning and establishment of standards of performance again lead to acceptance of the rules by those ruled and consequently to better motivation and more congenial relationships.

### *Participation in Control*

The democratic challenge also embraces managerial prerogatives in the field of control. Employee representatives sometimes sit on committees that administer rules or pass judgment on the effectiveness of execution of plans. Safety committees may include employee representatives and may make periodic inspection trips to see how well

<sup>4</sup>Ross G. Walker insists upon acceptance of budgets by department heads as a fundamental of budgetary control. Talk before S.A.M. annual conference, December 6, 1937. James O. McKinsey stressed the value of having budgetary estimates originate at the point of performance with review and consolidation upward through the organization. *Budgetary Control*, The Ronald Press Company, New York, 1922.

safety regulations are enforced. Union representatives or shop stewards may sit on merit-rating and promotion committees to see that merit-rating rules are equitably applied to all employees. They may participate on suggestion committees to sift employee suggestions and confer rewards commensurate with the values of suggestions adopted. Labor-management committees may participate in both planning of operations and subsequent control of execution.

Formal grievance procedures are now included in many union contracts. The machinery provided may be invoked in protest against managerial plans or policies, but this aspect of labor-management relationships is more likely to be implemented by collective bargaining negotiations. The grievance machinery is predominantly a vehicle for protests by employees with regard to how policies are administered. Typically, any employee who feels unfairly treated may report such treatment to foreman or shop steward as he chooses. If he chooses the shop steward, the latter discusses the situation with the foreman either as an actual case, naming names, or as a hypothetical issue. If no satisfactory explanation or corrective action is obtained from the foreman, the steward reports the situation to the union and formal written complaint is made. Evidence is heard and a judgment rendered at a subsequent meeting of the grievance committee, typically composed of equal union and management delegations. Provision is increasingly made for arbitration by a mutually acceptable neutral if the grievance committee is itself equally divided.

Many efforts are being directed toward making governments, schools, and families more democratic. The extension of democratic concepts of participation in planning and control to industry is perhaps more difficult than extension to any other sphere. Conflicting economic interests among managers, employees, owners, and customers make the technique of reaching a consensus of opinion through co-operative study of facts unusually difficult. It will be interesting to watch competition between companies following the newer, more democratic practices and those organized in traditional despotic patterns. A coordinate and related problem is the question of how far governments will go to help the democratic organization of industry.

#### REPORTS TO PRESSURE GROUPS

As indicated in Chapter 2, management is subjected to pressures by stockholders, customers, employees, competitors, and governments. Each group tries to control management for its own advantage. Each seeks information about the enterprise to aid in appraising plans and

operations of the company and to guide in determining the direction, intensity, and method of pressure to be applied. This control is a two-way street. Management tries to control each such group, to get it to act as management desires. Usually this is a matter of persuasion rather than one of coercion. Management should take advantage of stockholders', employees', and customers' desire for information by using it as a channel of persuasion. By providing information, management can often secure the cooperation of a potentially recalcitrant group. Without authentic information, members of a pressure group guess at the facts, and their guesses are colored by their fears. Typically, workmen and customers believe profits are higher than is actually the case and resent exploitation; whereas if they knew the facts, they would be satisfied and cooperative.

Each group has its own particular interests about which it especially desires information. Each also wants to know how every other group is faring because each tends to suspect it is being exploited for the benefit of others. Therefore all reports sent to any group should be made available to all. With this proviso in mind, the following outlines the information of particular interest to each group.

#### *Data of Particular Interest to Stockholders*

Current corporate reports are most nearly adequate to the needs of stockholders. Conventional balance sheets and statements of profit and loss evolved largely as a result of stockholder and creditor pressures. Recent additional information of great value has been made available through proxy notices, stock-exchange regulations, and S.E.C. rules. These data include beneficial interests of directors in company, compensation of directors and officers, major salaries and fees paid by company, and purchases and sales of company stock by directors and officers. These additional data reflect the divorce of ownership from management, the divergence of interests of the two groups, and the need of absentee owners, especially minority interests, for protection against exploitation by controlling interests or emancipated managements.

Large, progressive companies are generally providing reasonably adequate data, often more than stockholders will read. Much room remains for improvement by smaller or less progressive companies. Improvement seems especially needed in presenting data concerning surplus adjustments, which sometimes greatly exceed profit figures, and in presenting comparative data for a reasonably long sequence of years. Comparative data disclose trends and provide historical stand-

ards by means of which current performances may be more adequately judged. Such data should be corrected to allocate incomes and expenses properly to appropriate periods (instead of merely adjusting surplus) and should show both raw data and data adjusted to changes of price levels (which is virtually never done, nor are sufficient data given to enable stockholders to make such adjustments).

Stockholders are particularly interested in the current value of their shares, the trend in such values, earnings per share, dividends, and rate of return. Where earnings exceed dividends year after year, profits are plowed back, the stockholders' investment grows, and ultimately dividends should be increased, or rate of return on investment becomes progressively less satisfactory.

There is an increasing possibility, especially where stock is widely held by absentee owners, of an emancipated management regarding such plowed-back earnings in excess of reasonable dividends as a reserve to maintain dividends (and possibly wages) in depression years or as a means of increasing the social value of the company through expansion, research, community improvement, depression spending, etc. Once a management is completely divorced from ownership and ownership is sufficiently divided to result in effective management control of the business, the management is free to respond to the pressures to which it is subjected according to its own judgment of the power of each group and of the (socially) desirable distribution of company revenues current or past. Where such a view begins to take hold, stockholders become much more interested in what customers, employees, and the public are getting out of the company.

#### *Data of Particular Interest to Customers*

Customers are interested in the data showing the stockholders' stake in the company. A profitable company is generally a reliable and continuing source of replacement parts and repair services. Again, where management has become a relatively free arbiter of pressures, a sort of trustee managing a company for the welfare of all parties, customers want to judge if stockholders are receiving an inordinate share of the benefits accruing from company operations. Such judgments partially determine the intensity and form of the pressures customers will exert on management and on governments.

Of direct concern to customers are data showing sales volumes, selling expenses (analyzed), improvements in product quality and design, prices, backlogs, deliveries, complaints and adjustments, and repair services. This is probably one of the most neglected oppor-



tunities to cultivate customer and public good will and to educate employees as to company objectives and needs. If these data were accumulated and reported in comparative form to reveal trends, management could use them as an effective report showing how it has discharged its trusteeship responsibilities. A company can go far toward proving a high social value by reporting a large and increasing sales volume, a relatively small and decreasing selling expense, a history of product improvement, low and decreasing prices, prompt deliveries, few and diminishing complaints met with prompt and adequate adjustments—in general, a history of customer satisfaction.

#### *Data of Particular Interest to Employees*

To an ever greater extent labor is becoming interested in obtaining a "look at the books." As collective bargaining on an industry-wide basis replaces competition among workers for jobs and among companies for employees, wage determination becomes progressively less a matter of marginal equilibrium and more a matter of political maneuvering. If labor finds customers and stockholders relatively well taken care of, it is in stronger position to urge its own needs. If customers are provoked into a buyers' strike or funds cannot be raised because investors are dissatisfied, labor is in poorer position to push its case. To limit labor's demands to the sweetly reasonable, management will increasingly find it desirable to give labor data showing the company's treatment of customers and investors.

Of greater concern to labor and therefore a more important instrument of managerial persuasion are data reporting the company's treatment of employees. Such data should include average hourly rates, weekly take-home, annual earnings, and further data showing distribution and trend of these items. Data should also be distributed showing hours of work, stability of employment, turnover, promotions, layoffs, discharges, number and settlement of grievances, number and cause of accidents, employee benefits, and changes in working conditions. By forcefully and repeatedly presenting a history of improvement in these respects, management can persuade labor and public that company operations should not be interrupted by strikes or other labor trouble.

Managements are becoming more sensitive to labor relations as well as public relations. They are publishing more reports containing more information, arranged to be more easily understood by the layman. An executive vice-president appears at the annual party to explain steps taken to maintain future volumes in the face of cut-

backs on government orders. He shows pictures of new product designs and explains a revision of sales department organization. Throughout his talk he adopts an attitude of a trustee reporting on his administration of a trust. He could be no more conciliatory or deferential during his report to the board of directors or to a stockholders' meeting.

### *Summary*

Each group is interested in data showing total service and distribution and trend for every group. Each tends to watch treatment of the others to judge when and how it can most effectively press for further advantages for itself. Because of these reciprocal interests, data should report the size and stake of each pressure group; the number of stockholders, general distribution of stock, total investment, dividends paid, and rate of return on investment; number and distribution of customers, sales volume, selling expenses, and profit per dollar of sales; and number of employees, man-hours, pay roll, ranges of earnings, and profit per employee. Most people have difficulty with large numbers. By presenting company data, *e.g.*, balance sheet and income statement, in unit terms—per share of stock, per dollar of sales, and per employee—the relative importance of figures is emphasized.

These data are all needed by the various pressure groups if they are to exert an intelligent control over management. The alternative appears to be unintelligent pressure seeking unlimited ends. Management must seek a reasonable settlement with each group. Data reporting is a major persuasive device tending to keep demands limited to the reasonable capacity of the enterprise to satisfy pressures. It is a means by which management can exert considerable control over the representatives of the pressure groups.

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## CHAPTER 11

### ILLUSTRATIONS OF MANAGERIAL CONTROL

Purposes of chapter: to illustrate the processes of managerial control, to develop in greater detail the managerial control of processing activities, the preparation and use of indexes of performance, and the control of special events such as introduction of a new model.

The three illustrations of this chapter were chosen because of their importance and variety. Control of processing activities involves a daily detailed control of relatively homogeneous physical phenomena. Control of burden involves a wide variety of physically heterogeneous costs. Control of special events is largely a matter of special scheduling and follow-up. Among them they represent nearly all major control problems of management.

#### CONTROL OF PROCESSING ACTIVITIES

The following discussion outlines a procedure for "policing at the source" using mechanical aids. One company using the method makes a varied line of heavy equipment. A single finished unit contains from 400 to 800 parts. Each part requires from 5 to 20 operations before it is ready for assembly. Thus a single finished unit represents between 8,000 and 10,000 operations. Most production orders call for lots of 1 to 50 finished units.

Another company using a substantially similar system produces certain types of office equipment—much lighter than the heavy equipment produced by the first company. Each item again consists of approximately 600 parts, and each part requires from 5 to 20 operations. The product, however, is more highly standardized, and production releases run in lots of 200 to 500 units. A third company, using a similar system, makes sheet-metal products, and a fourth makes plumbing specialties. The method is reasonably versatile.

#### *Standards Required*

Standards are set covering every aspect of every product. Standard bills of material show detailed specifications and quantities of materials

required for every part of every product. Standards are established for setup and running times for every operation on every part of every product. Tools, machines, fixtures, gauges, and all other equipment necessary for each operation are all predetermined.

The whole of these data are reduced to the form of punched tabulator cards, approximately 10,000 such cards for each product. The first card in the file designates the product and shows its breakdown into major assemblies. There is a card for each major assembly showing its breakdown into subassemblies and one for each subassembly showing the breakdown into parts. A card for each part shows the standard bill of materials necessary to produce the part. Finally, there is a card for each operation on each part. The operation card shows the machine to be used; the jigs, fixtures, and tools necessary; the standard time for setting up the operation; the standard operating time per unit; the standard job classifications of setter and operator; the number of such parts needed for one finished unit; and the travel time required from issuance of an order for the part to shipment of the assembly of which the part becomes a component. These cards are kept in a permanent file and are used as master cards from which the cards used to direct operations are prepared.

#### *Origin and Issue of Shop Orders*

The machinery of production control begins with sales orders, repair orders, and estimates of future sales for standard items. These data are analyzed by the production planning department, and economic runs of the various parts and products are determined. A shop order is released for production whenever anticipated shipping requirements and condition of inventory indicate the necessity of running another group of items. The first step in releasing such an order to the shop is to remove the 10,000 or so cards representing that product from the master file and mechanically duplicate them, automatically multiplying running times by the number of parts specified. Two such copies are made of each operation card. The master cards are then returned to their permanent file.

One set of duplicate operation cards are sorted according to machine numbers of the machines on which the operations are to be performed. The other set of operation cards are sorted according to the sequence in which operations must be performed in order to have each part ready for final assembly when needed. One part, for example, may have to be started 8 weeks before final shipping date in order to reach the assembly line at the right time. If it arrives too soon, it

will clog up the assembly floor and occupy expensive production floor area. If it arrives too late, it will hold up the job and delay the shipping date, while other parts congest assembly areas waiting for this component. Another part may have to begin its trip through the factory only 2 weeks before the final shipping date. The operating card for the first part would be released 6 weeks before that for the second part.

The operating card giving the data for the first operation on a part, the material card for the materials required for the part, the necessary blueprints, and other instructions are placed in an envelope and sent to the shop. The punched cards carry a printed statement of the data punched into the card, which enables shop men to read the card and treat it as an order from the planning department. The material card acts as a material requisition directing the stock room to deliver the material shown thereon to the first processing department. The material is delivered, and the material card returned to the planning department, where it is posted to the issue column of the appropriate perpetual inventory card.

The operation card that has gone to the factory instructs the workmen to perform a certain operation on a certain part using certain tools and certain machines and allows them a certain standard time to set up the job and another standard time to run it. The workman marks his clock number on the card and stamps the time the job is started. When he has finished his job, he stamps the time finished on the card. If an inspection is performed at this point, the number of pieces good and the number spoiled are marked on the card. The card is then sent to the tabulating department. In the tabulating department, the workman's clock number, the elapsed time, and the spoilage are punched into the card. The card then goes to the planning department. This serves as notice to release the card ordering the shop to perform the next operation on the part. This continues until the part is finished. As the operating cards come back from the shop, a clerk finds and removes the duplicate card from the file arranged by machine numbers.

### *Operating Reports*

This procedure enables the production planning and cost departments to achieve control of shop operations:

1. Once a week or oftener as desired, the operation cards filed by machine numbers are passed through a tabulating machine, and totals of the number of hours ahead of each machine in the entire factory

are automatically printed on a report that goes to the appropriate manager. Where machines are overloaded, where too many hours are planned ahead for the machine, the manager considers ways of breaking the bottleneck. Should some of the processes or parts loading this machine be farmed out to other companies? Should the overloaded equipment be run extra shifts or overtime? Can some of the jobs be rerouted over less appropriate equipment without too great increase in operating costs? Should new machines of similar types be acquired? On the other hand, if some of the machines are too lightly loaded, the manager considers the advisability of running jobs further in advance, of transferring work from other more crowded equipment, or, if the machines are chronically idle, of disposing of them.

Some companies that attempted preparation of machine-loading reports without mechanization found the report a terror. Consequently, it was prepared at infrequent intervals. When prepared annually, it took a week or two to develop the data. As a result, the report presented information as to the machine loading a week or two previous to the time the data were made available. In many instances the loading had changed so materially as to render the report hopelessly inadequate and obsolete. With mechanized procedures, the loading report presents data as of the preceding day.

2. The operation cards are sent to the tabulating section every evening, where they are sorted by clock numbers and a tabulator report prepared. A separate sheet is devoted to each department. Each line shows the actual and standard hours that a workman spent on a particular job, followed by the per cent efficiency found by dividing the standard hours by the actual. In some companies the standard hours are multiplied by a standard wage rate for the job, the actual hours by the actual wage rate, and a pecuniary efficiency also found.<sup>1</sup> Subtotals show the over-all efficiencies of each workman for the day. In printing the report, the workmen are ranked from the best efficiency record at the top of the page to the worst at the bottom. A summary sheet is also prepared with a line for each department—

<sup>1</sup> Pecuniary standards of labor cost may also prove useful. Under some circumstances, workers of substandard skill may be assigned certain jobs. This is likely to result in the expenditure of more time than the standard allows. However, since such workers are likely to be paid less per hour than those of standard skill, the money cost for labor does not ordinarily deviate so far from standard as does the time cost. It is possible for an operation to exceed standard time while involving less than standard money cost for labor. Depending on load conditions, the excess time may or may not involve a real increase in burden expenditures.

also ranked with the best record at the top and the worst at the bottom. (See Fig. 9.)

These reports reach the manager the following morning. He glances at the departmental recapitulation and turns to the departmental reports of the poorest departments. There he finds the jobs that gave the most trouble at the bottom of the sheets. The report locates the

DAILY DEPARTMENTAL EFFICIENCY RECORD													
Day Shift _____ DEPT. NO. _____										Night Shift _____		DATE _____ 194 _____	
Line	Mach. No.	Chk. No.	Order No.	Part No.	Opn. No.	Standard Pieces Per Hour	Pct.	Std. Hrs.	Act. Hrs.	% Std. of Act.			
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
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26													

FIG. 9. Form for report of daily operating efficiencies of operators and departments.

trouble as to workman, job, and machine. The manager confers with the foreman about these jobs, discussing the reasons for the poor performance and the remedial action to be instituted to prevent continuance. This is almost as prompt and as pointed as the direct personal supervision given by the foreman.

Periodically each workman's record is recapitulated and filed permanently in the personnel department. Here the records become the basis of a measured day rate wage plan. Hourly wage rates are adjusted quarterly in accordance with the efficiency records accumulated during the preceding quarter. The succession of layoffs and transfers to preferred jobs and other privileges are partially determined by the efficiency records. Every man in the factory knows of





Special orders are fitted into the procedures in the course of preparing the engineering estimates on which bids are based. The engineering department designs the special products, preparing drawings, bills of materials, and operation sequences. It indicates the machines and tools to be used and estimates the operating time involved. These data are used as a basis for bidding on the job. If the job is sold, the estimated times and the bills of material set up as a basis for bidding are punched into cards to serve as standards. One company reports that approximately 2 per cent of the operation cards need correction on the basis of actual timing of the first run. The estimates on the remaining cards are close enough to require no correction.

These procedures are not so expensive as they sound. One company, using tabulating equipment for analysis of sales, increased the monthly rental of such equipment from \$800 to \$1,300 per month when the control system was installed. It now gets more pertinent, much more timely data, with less error and a reduction in clerical costs more than sufficient to absorb the increased rental of tabulating equipment.

#### BURDEN CONTROL AND INDEXES OF PERFORMANCE

As with control of processing, burden control should be as particular, precise, and proximate as possible. Unlike process control, burden control almost necessarily is by periods rather than by operations. As with all forms of managerial control, the process of burden control involves establishment of standards, comparable measurements of performance, comparison, and institution of remedial action.

#### *Standards*

As part of the process of managerial planning, rival programs of action were compared by means of budgets. When the most attractive plan was selected, its associated budget became part of the guide to action for all managers at all levels of the enterprise organization. Items entering this budget are reclassified according to individual responsibilities. The result is a hierarchy of budgets detailing the achievements and expenditures and investments expected of every member of the managerial hierarchy. These estimates constitute the normal budget.

The activities of many departments depend upon the successes and failures of other departments. Thus production, personnel, and purchasing activities should be reduced below their budget estimates if sales volume lags behind its estimated level. Conversely, factory man-

## BURDEN CONTROL

		Department      Punch Press	
		Period	Week ended August 2
Work loads (1) and costs (c)	(1) Normal budget	(2) Adjusted budget	(3) Actual
Cases produced—units (1)		—	Column 3 Column 1
Frames produced—units (1)		—	Column 3 Column 1
Total standard hours produced (1)	X	—	Column 3 Column 1
Materials handling—hours (c)			Column 2 Column 3
Supervision—hours (c)			Column 2 Column 3
Spillage—rework cost plus standard dollars scrapped (c)		Change not proportional to Y:X	Column 2 Column 3
Labor turnover—new employees (c)	This cost is part of the work load of personnel department	$\text{Column 1} \times \frac{Y}{X}$	Column 2 Column 3
Retraining—employee-hours (c)	This cost is part of the work load of personnel department	Not proportional	Column 2 Column 3
Grievances—number (c)	This cost is part of the work load of personnel department	Not proportional	Column 2 Column 3
Maintenance—hours (c)	This cost is part of the work load of maintenance department	Not proportional	Column 2 Column 3
Maintenance—dollar charges (c)	This cost is part of the work load of maintenance department	Not proportional	Column 2 Column 3

Fig. 11. Form for reporting and controlling work loads and costs of a processing department.

## BURDEN CONTROL

		Department		Personnel	
		Period		August	
Work loads (1) and costs (c)	(1) Normal budget	(2) Adjusted budget	(3) Actual	(4) Per cent efficiency	
New employees—number (1)	A	—	B	Column 3 Column 1	
Interviewing and testing—hours (c)	C	May equal $C \times \frac{B}{A}$		Column 2 Column 3	
Training and inductance—hours (c)	D	May equal $D \times \frac{B}{A}$		Column 2 Column 3	
Total employees (1)	E	Adjusted for changes in estimated volume $G$	F	Column 3 Column 2	
Cafeteria—dollar cost (c)		Change not proportional to $F \div E$		Column 2 Column 3	
First aid and safety—dollar cost (c)		Not proportional		Column 2 Column 3	
Transfers and promotions—number (1)	X	May equal $X \times \frac{G}{E}$	Y	Column 3 Column 2	
Transfers and promotions—clerical hours (c)		Column $1 \times \frac{Y}{X}$		Column 2 Column 3	

FIG. 12. Form for reporting and controlling work loads and costs of a service department.

Note: A in Fig. 12 stands for the number of new employees predicted in the normal budget. In use, a number would, of course, replace A. B represents the number of new employees actually hired. Dividing B by A (column 3 by column 1) shows how much the personnel department achieved relative to expectations, i.e., how far its actual work load (work accomplishment) exceeded or fell short of its anticipated work load. The normal budget estimate for hours of interviewing and testing, C, probably needs adjustment for the difference between actual and anticipated new employees; hence  $C \times \frac{B}{A}$  = adjusted budget. Being a cost, per cent efficiency will be good when actual is below estimate; consequently here column 2 must be divided by column 3.

ager, personnel department, and others should be allowed expenditures in excess of their budgets if sales volume is substantially in excess of the budgeted figure. Thus standards of achievement, cost, and investment must be adjusted to conform to actual circumstances before actual performance can be judged by their aid.<sup>2</sup> The adjustments, as indicated, may be necessitated by variations of sales volume from plan. Or they may be necessitated by variations in number of patterns, number, and size of sales orders or many of the other dimensions of management problems.

All these standards and adjustments should be made in terms of individual responsibilities for specific physical and pecuniary items. Each expenditure (and sometimes investment too) should be associated with its corresponding achievement. Figures 11 and 12 show one method of making adjustments and tying each expenditure to its associated achievement and both to individual responsibilities. Such a form is prepared each period for each subordinate to be controlled. Separate forms may be used for items having natural weekly, monthly, quarterly, and annual periodicities. The forms given for punch press (processing) and personnel (service) departments are merely suggestive. The idea must be tailored to fit specific companies, departments, and circumstances.

Note that in Figs. 11 and 12, percentage of efficiency for achievements is found by dividing column 3 data by corresponding data in column 2 and percentage of efficiency for expenditures by dividing column 2 data by that in column 3. Also notice that sometimes a cost budget is adjusted in proportion to actual divided by normal budget and sometimes a nonproportional adjustment resting on judgment is more appropriate. In general, all figures in the adjusted budget column depend on judgments of the type discussed in Chapters 4 to 9 in connection with managerial planning.

### *Managerial Control*

At the end of each period, adjusted budget, actual, and percentage of efficiency figures are promptly entered. A clerk can red circle significant deviations from plan and pass the reports up the managerial line. Each manager can add explanations of causes and outlines of remedial action undertaken or recommended. In this manner, burden

<sup>2</sup> See Williams, *The Flexible Budget*, McGraw-Hill Book Company, Inc., New York, 1934; also Gardner, *Variable Budgetary Control*, McGraw-Hill Book Company, Inc., New York, 1940.

## EXECUTIVE BONUS PLAN AND BURDEN CONTROL

Department		Sales					
Period		March					
Item	(1) Per cent efficiency	(2) Adjusted budget	(3) Actual	(4) Importance weight	(5) Controllability weight	(6) Weighted budget	(7) Weighted actual
Achievements:							
Sales—units	Achievements	Assignments	Achievements,	Effect on company	Susceptibility to	Column 2	Column 3
Gross profit—dollars	Assignments	(normal budget	physical or	profits on an in-	control by sales	× column 4	× col-
Customer contacts	Column 3 data	adjusted as in	pecuniary	cremental basis	manager	× column 5	umn 4 ×
Demonstrations	Column 2 data	Figs. 11 and 12)					column 5
Service calls							
New accounts							
Costs:							
Salesmen—number	Allowances	Allowances	Actual costs,	Effect on company	Susceptibility to	Total A	Total B
Commissions paid	Actual costs	(normal budget	physical or	profits on an in-	control by sales		
Traveling expense—dollars	Column 2 data	adjusted as in	pecuniary	cremental or op-	manager		
Direct by mail—dollars	Column 3 data	Figs. 11 and 12)		portunity basis			
Periodical advertising—dollars							
Training—personnel dept.—hours							
Severances—number							
Supervision—administrative books							
Investments:							
Sales automobiles	Column 2 data	Investment	Replacement	Carrying charges	Susceptibility to	Total C	Total D
Demonstration kits	Column 3 data	budget adjusted	cost minus	on out-of-pocket	control by sales		
Sales manuals		for volume, etc.	appropriate reserves	basis	manager	Total E	Total F

FIG. 13. Form used to compute executive bonus and to control burden for sales department.

## EXECUTIVE BONUS PLAN AND BURDEN CONTROL

Department		Production Control					
Period		Week ended June 7, 1947					
Item	(1) Per cent efficiency	(2) Adjusted budget	(3) Actual	(4) Significance weight	(5) Authority weight	(6) Weighted budget	(7) Weighted actual
Achievements:							
New orders scheduled—number							
Engineering changes							
Tabulator cards punched							
Time tickets posted							
Requisitions written							
Progress reports made							
Costs:							
Clerical hours						Total A	Total B
Stationery—pounds							
Space—square feet							
Supervision—hours							
Investment:							
Comptometers						Total C	Total D
Typewriters							
Desks							
Files							
						Total E	Total F

Fig. 14. Form for computing bonus and controlling burden for a service department. Note use of weekly period. There could be a second such form for the same department carrying items which fit more naturally into a monthly period.

## FOREMAN BONUS PLAN AND BURDEN CONTROL

Department		Final Assembly					
Period		Week ended June 7, 1947					
Item	(1) Per cent efficiency	(2) Adjusted budget	(3) Actual	(4) Significance weight	(5) Authority weight	(6) Weighted budget	(7) Weighted actual
Achievements:							
Shovels assembled							
Graders assembled							
Standard hours output							
Costs:						Total A	Total B
Direct labor hours							
Move men—hours							
Supervision—hours							
Employees—number							
Grievances							
Small tools—dollars							
Supplies—dollars							
Power—kilowatt-hours							
Spoilage							
Investments:						Total C	Total D
Power tools—dollars							
Welding equipment—dollars							
Fixtures—dollars						Total E	Total F

Fig. 15. Form for computing foreman bonus and for controlling burden of an operating department.

## BUDGET REPORT

Department Purchasing  
 Month ended September 22, 1945

## Work Load

Factor	Estimate	Actual	Weight *	Weighted estimate	Weighted actual	Over	Under
1. Purchase orders—number.....	2,000	2,011	0.9127	1,825	1,835	10	
2. Purchase invoices approved—number.....	1,500	1,618	0.3645	547	590	43	
3. Purchase returns—number.....	150	163	0.3505	53	57	5	
4. Purchase mail—pounds.....	80	74	2.173	174	160		14
5. Fixed.....				416	416		
6.							
Totals.....				3,015	3,058	58	14
Net over or under.....						43	
Per cent over or under.....						1.4	

\* Estimated hours per unit of each factor.

## Pay Roll

Factor	Budget	Adjusted budget	Actual	Over	Under	Variation
7. People in department—number.....	20	20	20			0
8. Hours—number.....	3,015	3,058	2,984		74	2.4
9. Average rate per hour.....	0.65	0.65	0.68	0.03		4.4
10. Total departmental pay roll.....	1,959	1,988	2,029	41		2.1

On reverse side show (1) explanation of variations, (2) remedial action undertaken, and (3) remedial action recommended.

FIG. 16. Form for budget report for purchasing department. Similar to form shown in Fig. 13, but for purchasing instead of sales department, and with all weights reduced to standard hours and all costs neglected except actual clerical hours.



is brought under the same kind of particularized, proximate control as was outlined for processing and assembly operations earlier in this chapter.

## BUDGET REPORT FOR PERIOD SEVEN

Department Purchasing  
Four weeks ended September 22, 1945

Factor	(A) Period 7 Work load	(B) Hours per unit	(C) Period 7 Budget Product of column A, B	Period 6 Budget	Period 5 Budget	Period 4 Budget	Period 3 Budget
1. Purchase orders— number.....	2,011	0.9127	1,835	1,189	1,438	1,906	1,546
2. Invoices approved— number.....	1,618	0.3645	590	637	599	679	625
3. Returns—number..	163	0.3503	57	75	25	52	57
4. Purchase mail— pounds	74	2.173	160	139	145	164	157
5. Fixed.....			416	416	416	416	416
6.							
7.							
8.							
9.							
10.							
11.							
12.							
Total budget.....			3,058	2,456	2,623	3,216	2,801
Actual hours.....			2,984	2,650	3,036	3,357	2,954
Workers in department.....			20	20	22	22	22

FIG. 17. Same as Fig. 16, further simplified and with trend data introduced.

### *An Executive Bonus Plan*

If higher management wants a general index of performance for each subordinate, perhaps as a basis for a bonus incentive plan, each item on the burden report must be weighted to enable reasonable con-

solidation into a single over-all criterion. This is done by means of a report similar to those shown in Figs. 13 to 15.

The major differences between these forms and those of Figs. 11 and 12 are the grouping of achievements in one section, of costs in another, and of investments in a third; the introduction of weightings for importance and controllability; and the calculation of weighted criteria of efficiency. As with Figs. 11 and 12, these forms are only suggestive. The items included and the weighting should be tailored to fit specific departments, companies, and circumstances. Figure 16 is the result of weighting all achievement items according to standard hours, assuming that all items are equally subject to control and ignoring all costs except clerical hours. This results in a simple, direct comparison between assigned work load expressed in standard hours and actual hours used—reminiscent of the departmental efficiency reports for control of direct labor. Figure 17 is further simplified with trend data introduced.

Efficiencies on individual items of achievement, cost, and investment are shown in column (1) of Figs. 13 to 15. Over-all achievement efficiency for the department is found by dividing Total *B* by Total *A*. Cost efficiency is found by dividing Total *C* by Total *D*, and investment efficiency by dividing Total *E* by Total *F*. Each of these three efficiency criteria are then multiplied by an importance weighting and added to find a "bonus factor." The bonus factor is graphically related to a bonus per cent of salary, somewhat as shown in Fig. 18 below:

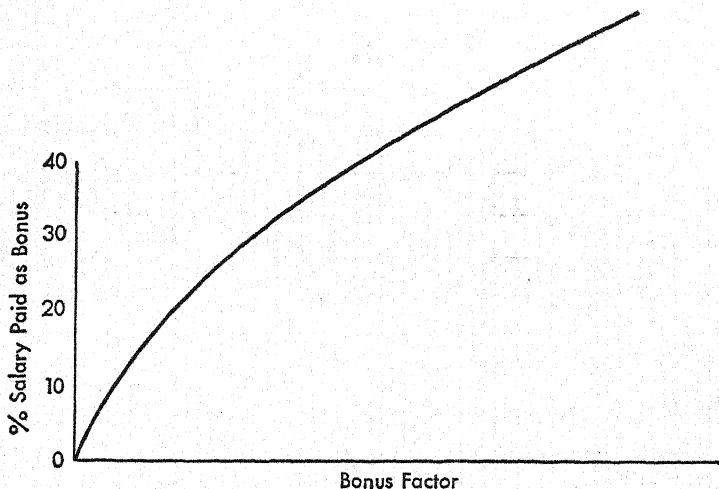


FIG. 18. Graphic computation of bonus from bonus factor.

The plan has sufficient elements of flexibility to be adjustable to almost any situation: The items to be included, the unit of measurement selected for each item, the importance weighting, the controllability weighting, the weighting of the ratios of the totals, and the shape of the bonus curve are all subject to adjustment according to the needs and judgment of management. And changes can be made from period to period as necessary.

In devising and installing such a plan, it should be experimentally developed over many periods before being introduced. Management should try various items and weights and curves until the pattern of results conforms to managerial judgments of conditions. Once the plan is installed, all the items of flexibility should be settled before the bonus period begins, and all executives compensated under the plan should know precisely how all calculations will be made. Usually it will be desirable for all concerned to work out the details of the plan together and to legislate any subsequent changes in the plan together. Then all should understand the purposes and procedures, and a minimum of misunderstanding and maximum of desirable motivation should result.

#### INTRODUCTION OF A NEW MODEL

This treatment is limited to the control of the introduction of a new product from experimental model to first shipments to customers. Development engineering, factory processing, and sales activities are other and largely independent stories. This analysis begins with an experimental model that gives satisfactory performance.

##### *Control Points*

The putting of a new model into production is a series of operations. Usually all preceding operations must be completed before succeeding operations can be undertaken. Attempts to "shingle" the operations of the sequence are likely to result in much waste time and excess cost.

The successful experimental model is torn down, and product drawings prepared. These will include all part and assembly drawings needed. Cooperation of development engineering with production engineering at this stage will save much time and eliminate many engineering change notices later. If physical or chemical properties of constituent materials are critical to product performance, materials specifications will also be drawn up by development engineering.

These drawings and specifications are sent to tool and production engineering.

There, each part is analyzed into operations needed to produce the part. Special tools, fixtures, and gauges are designed, and drawings and materials specifications prepared for them. Also all standard tools, fixtures, and gauges are specified. This process may involve redesign of some parts for more economical production. Such changes require checking and approval by product development engineering. Tool and production engineering also prepares the necessary bills of material to show quantities required of each raw material and purchased part. As these data are completed, they are forwarded to the methods department.

Here, operations are further analyzed into motion patterns and are assigned to machines or production centers. As soon as methods have checked operation sequences, tooling, and gauging, tool, gauge, and fixture drawings are released to toolroom for production. Standard time data are built up into setup and operating standard times, and standard-practice instructions are written up. All data are sent on to the production planning department.

Production planning routes, schedules, and dispatches shop operations. When the factory has followed these instructions, the new model comes off the assembly line ready for shipment.

As each part or each assembly completes each step outlined above, there is a transfer from one agency to the next. These points of transfer are strategic to that fixing of responsibility necessary for managerial control.

#### *Scheduling and Follow-up*

A record can be prepared with columns for each control point and lines for each constituent part and assembly. Double columns, double lines, or split boxes will be necessary, one place for a scheduled date and an adjacent space for an actual date (see Fig. 19).

Each control point for each part and assembly should be scheduled, preferably in conference with the person responsible for the performance. If he has accepted the time interval allowed between completion of the preceding operation and completion of the operation for which he is responsible, he will be more strongly motivated to meet the scheduled date. Later the dates of actual completion are entered and compared with the scheduled date. The regular pattern of managerial control thus begun proceeds in its customary channels. Devia-

NEW MODEL SCHEDULE										Model # <u>9</u>					
Description of Model										Date _____					
ITEM		Product drawings completed	Tool drawings completed	Tools ready	Fixture drawings completed	Fixtures ready	Gage drawings completed	Gages ready	Operation analysis completed	Standard practice instructions	Standard times computed	Shop order routed	Shop order scheduled	Shop order released to factory	Operations completed
Final Assembly	# 9														
Assembly	# 9A														
Subassembly	# 9A1														
Part	# 9A1a														
Part	# 9A1b														
Part	# 9A2														
Assembly	# 9B														
Part	# 9B1														
Part	# 9B2														
Part	# 9C														
etc.															

FIG. 19. Record for controlling the progress of a new model into production.

tions of performance from plan are investigated, the causes ascertained, remedial action instituted, and the remaining plans adjusted in the light of these developments.

#### RELATED READING

##### *Control of production and of direct costs*

DAVIS, R. C.: *Industrial Organization and Management*, Chaps. 5, 11-17, 19, 20, 28, Harper & Brothers, New York, 1940.

KNOWLES and THOMSON: *Industrial Management*, Part V and Chap. 33, The Macmillan Company, New York, 1945.

LANSBURGH and SPRIGEL: *Industrial Management*, Part VII, John Wiley & Sons, Inc., New York, 1940.

MITCHELL, W. N.: *Organization and Management of Production*, Chaps. 5, 10, 11, 12, McGraw-Hill Book Company, Inc., New York, 1939.

##### *Burden control*

DAVIS: Chaps. 18, 30.

KNOWLES and THOMSON: Part VI.

MITCHELL: Chap. 9.

## CHAPTER 12

### SUMMARY AND CONCLUSIONS

Purposes of chapter: to review and summarize the analysis, to compare and contrast managerial accounting and traditional legal-financial accounting, and to reemphasize the role of managerial accounting as a servant of management.

This last chapter summarizes and integrates all that has gone before. Traditional legal-financial accounting is used as a foil, to make the objectives, premises, and methods of managerial accounting stand out sharper by contrast.

### OBJECTIVES

#### *Of Traditional Accounting*

Beginning with the needs of the merchants of the Italian city states for a record of receipts and disbursements, receivables and payables, accounting evolved into the double-entry system of recording an enterprise's pecuniary history. The emphasis on cash and debts was so great and the systems so incomplete that even as late as 1920 accounting texts usually included a treatment of "single-entry" (incomplete) systems of record keeping. Until the income tax made annual profit statements obligatory, many firms closed their books and ascertained profits at irregular intervals or not at all and many maintained fragmentary records of mediocre accuracy. Larger scale and greater impersonality added the pressures of trade and bank creditors to those of the tax bureau. The spread of the corporate form of business and the increasing separation of ownership from management added stockholders to the external groups pressing for complete and reliable accounting data. Perversions and abuses brought a vast increase in the demand for unbiased professional auditors. As loopholes were found and plugged, tax laws became more complex, and the professional auditor increasingly entered the tax field. The large demand for public accountants and the rapidly increasing complexity of the field gave rise to college curriculums devoted to training professional accountants. Much interchange of personnel between accounting

teachers and public accountants tended to stamp all accounting literature and curriculums with the tax and auditing orientation.

Banks, government tax bureaucrats, and professional accountants alike had little knowledge of or sympathy with management or engineering. Theirs was an essentially clerical approach, a paper discipline of business documents, books of original entry, ledgers, and trial balances. Legal aspects lent a reverence for precedent, proof, and formal single-valued rules. The need of external groups for objective, verifiable financial data and their power to compel enterprises to submit such data produced the traditional double-entry system preoccupied with the production of conventional balance sheets and income statements. Classification became conventional, and valuation a mere record of historical events.

### *Of Managerial Accounting*

As enterprises continued to grow, management evolved into a multi-level hierarchy, split vertically according to specialized functions. Impersonal relations developed within the enterprise as well as between the enterprise and its external cooperating groups. Management increasingly lost its knowledge of enterprise affairs formerly gained from personal, face-to-face contact with the detail of operations. Upper levels of the managerial hierarchy dealt increasingly with reports and summaries of operations; they dealt with the operations themselves only through a series of officials arranged into a branching pattern of chains of command. Specialists in one such chain were losing contact with those in other chains. Cross-purposes tended to develop, and managerial control tended to become lost in the mazes of a large organization.

Managerial accounting comes as an answer to this loss of direct personal contact, as a partial answer to management's need for data to use as a basis for coordinated planning and control of the operations of an enterprise. The objectives of traditional accounting lose validity in this context. Different managerial purposes and changing environments impose different classifications and evaluations of data, making managerial accounting a multivalued calculus. The past retains significance only as an index to the future, and historical values give way to current market values. Management is itself the only user of data developed by managerial accounting, thus eliminating the need for rigid conventions allowing verification by disinterested professional auditors. Judgment, managerial judgment, becomes a major determinant of classifications and evaluations.

Management seeks economic efficiency to enable maximum satisfaction of the cooperating pressure groups: stockholders, creditors, customers, employees, and public. To this end, management plans enterprise activities and seeks to force subsequent operation to conform to plans. It needs data to enable comparisons among alternate plans and rational selection of that plan which is most likely to result in most adequate satisfactions. It also needs data reporting current operations, comparing and contrasting actual operations with plans, revealing deviations from plans, and enabling swift, economical managerial investigation and remedy of undesirable conditions. Managerial accounting seeks to supply these data.

### PREMISES

#### *Of Traditional Accounting*

Because of the premium placed on objective, verifiable data, traditional accounting looks to the past for its values. This leads to the use of "original cost" as the major (or even sole) basis for evaluating assets and expenses. Accordingly, data are seldom (or never) revised as price levels change or errors of managerial judgment are discovered. Historical values can be documented and later verified by clerical checks from which all essential judgment factors have been excluded.

Classification of data follows an object basis. Accountants and public auditors can inspect objects, see, feel, and appraise them. If they are missing, error or fraud is revealed, as when a count of cash, inventory, or securities disagrees with the recorded balance. Objects also have relatively unique and discrete histories, making an object classification a convenient basis for verification of expenses (dissipated objects) as well as of assets. Minor shifts in definition of object classes or of conventional subtotals such as current assets or cost of goods sold as among enterprises are deplored but not serious. Shifts in definition within a single enterprise as between periods are strongly condemned and acceptable only when highly formalized.

Physical objects are often divided in the course of enterprise operations, and traditional accounting seeks objective, verifiable values for the fragments. The original associated value is divided among the fragments in strict arithmetic proportionality except in extreme cases where some fragments are ignored, *e.g.*, drill press borings or punch press scrap. Traditional cost accounting is a rather absurd attempt to carry the technique on through the entire production process. The result is a succession of rather arbitrary selections of physical bases to provide the arithmetic proportions to govern value distributions;



*e.g.*, a superintendent's salary may be distributed in proportion to number of employees, direct labor hours, direct labor cost, time spent by superintendent, etc.

The use of historical values, object classification, and arithmetic proportionality all stem from a need for data upon which parties of opposing interests can agree. Some such system seems necessary for taxing, credit, and legal purposes. The approach given in Chapter 7 does this traditional job with greater logical consistency than usual; *e.g.*, it provides for disclosure of liabilities under valid leases.

### *Of Managerial Accounting*

Managerial accounting follows a pragmatic and operational philosophy. Traditional questions, *e.g.*, what does a unit of product cost, are met with questions rather than answers: "What are data to be used for?" "What is management trying to do and why that instead of something else?" "How can it be done?" "What resources will be needed?" Solutions to problems are viewed as valid only within a specific frame of reference detailing purposes and situations. Since managerial questions are forward-looking, managerial accounting's classifications and evaluations also look ahead. Historical valuations and object classifications retain validity only in so far as they help managers foretell results of various proposed courses of action, and arithmetic proportionality is a dangerous tool to be used with great care.

Managerial accounting assumes that classifications and evaluations must grow out of managerial problems and consequently will change from problem to problem. For managerial planning, the primary classification depends upon the nature of the alternate programs under consideration and the secondary upon variations in the rules of valuation applied to the elements of various programs. For managerial control, primary classification depends upon the organizational pattern—the hierarchy of responsibility. The secondary classification again reflects variations in the rules of valuation applied.

For managerial planning, valuation in managerial accounting becomes a calculus of increments and opportunities erected on a basis of "present replacement" and "opportunity cost" values. The relevant questions are, "How much more will this program cost than that one?" "What can be gotten for this resource if it is no longer needed for this purpose?" The emphasis is on present or future, never on the past; on the more or less, never on the average; on purpose and method of management, never on abstract, absolute, single-valued truth. For managerial control, valuation in managerial accounting runs in terms

of ultimate importance to the enterprise and of the amenability of items to control by responsible individuals.

Managerial accounting keeps close to the facts and realities of life. It assumes acquisition of bundles of resources, bundles that differ by finite increments and exhibit nonproportional relationships between physical bundles of various size and their pecuniary concomitants, *e.g.*, quantity discounts. It assumes fragmentation of such bundles, often into qualitatively unlike portions, *e.g.*, product and scrap, direction of subordinates and clerical work, production areas and aisle space. It assumes fluctuating load factors with consequent variability in value of an item from peak to trough of the business cycle, from season to season, and even from hour to hour. It assumes irreversible cycles of operations leading to sunk costs, *e.g.*, inventories of obsolete parts, involving immobile factors of production. It assumes technological and social change, enhancing or depressing values. It is full of managerial judgment and has a low esteem for historical, proportional valuations.

## METHOD

### *Of Traditional Accounting*

Companies engage in transactions with other social and economic units. They buy and sell, borrow and lend, make and execute promises. Each transaction is represented by an original evidence reporting the making of a contract or the execution of a promise. These original evidences grow out of the interaction of the enterprise and its environment. The system is artificially extended to losses, accruals, and internal events by unilateral, executive origination or authorization of vouchers or other "manufactured" as against negotiated documents.

These evidences or documents funnel through the bookkeeping department, where each transaction or event is recorded in a journal. The journal entries analyze the data reported by original evidences as to accounts affected, whether debit or credit, amount, date, and reason if not self-evident.

Subsequently journal entries are sorted according to accounts affected by posting to ledgers. Clerical accuracy is checked by means of a trial balance. Adjustments are journalized and posted to make successive periods comparable, and financial statements are prepared. The entire process is outlined in greater detail in Chapter 7.

### *Of Managerial Planning*

Managerial planning begins with the discovery of a problem or a difficulty, by accident, by analysis of trends, by deviation of per-

formance from plans, by the "exception principle," or by systematic managerial audit. All these devices should be utilized, but the last tends to be the most thorough and most productive. The industry is studied as to its past history and recent trends. Its future is forecast by projecting such trends modified to give effect to current factors bearing on the industry. The company's past is compared with the industry's, and its recent trends superimposed on industry trends. Its future is forecast by projecting such trends modified by industry forecasts and by study of the changing position of the company in the industry.

Next, the enterprise's policies, resources, organization, and practices are reviewed, seeking explanations of shifting trends and relationships and checking internal consistency and orientation. Throughout all this analysis, a sharp watch is kept for likely alternate programs of action. Much help can be obtained both in locating difficulties and suggesting alternate programs from textbooks and by comparison with other similar enterprises. Catalogues, employees' suggestions, and motion study techniques are other prolific sources of alternate possibilities. Each managerial problem discovered is finally defined in terms of two or more alternate programs of future conduct.

These alternate plans are analyzed and detailed by reasorting a mass of physical engineering standards filled out by calculations and judgments. The resulting detailed physical programs are converted into value terms, into estimates of incomes, expenses, assets, and liabilities, by application of a calculus of increments and opportunities. These financial data are adjusted for probability and compound interest to make the programs directly comparable. Management does compare them and selects the most attractive: the one that seems to offer greatest probability of largest satisfactions to all the pressure groups. Finally the adopted program is watched as it unfolds in action. Does it work as planned? Has it been understood? Are explanations or adjustments needed?

#### *Of Managerial Control*

The selected plan is analyzed and its elements reclassified in terms of individual responsibilities, responsibilities as to work accomplishments, as to costs incurred, and as to resources employed. A hierarchy of standards is constructed, paralleling the organizational pattern of the enterprise. On the lower, operating levels, the standards are largely derived from engineering and methods studies and partly from detailed historical records. These are built into a structure of budgets

showing the responsibilities of each individual on every level of the administrative hierarchy.

The planning data are not merely reclassified. They are also re-evaluated. Since planning utilizes a calculus of increments and opportunities, the program elements are likely to be evaluated in terms of the importance of each to the enterprise. Further adjustment is needed to reflect the amenability of each constituent to control by each executive. Since higher level executives are responsible for operations of their subordinates and in addition reserve some decisions to themselves, their responsibilities will, in general, be greater than the sum of the responsibilities of their subordinates. New items such as personal staffs and private office facilities will enter on each level as the summation of responsibilities proceeds upward through the administrative hierarchy. And items included on lower levels will require re-evaluation as authority to change such items increases as upper levels are approached.

The final complex of standards, estimates, and plans is communicated to the individuals responsible for implementing and carrying out the program. Such communication is most effectively conducted by having the responsible individuals participate in the processes of managerial planning and of assignment of aspects or elements of the plans formulated to individuals for action. Participation tends to improve the plans and to reinforce motivation as well as to communicate the plans more completely and accurately.

Personnel are further motivated by incentive plans, supervision, and other financial and nonfinancial inducements. The resulting activities are inspected, and results recorded and compared with plans. Deviations between plan and performance are investigated to determine causes (again reinforcing motivation) and remedies. Growing out of such investigations are adjustments of plans and resources, transfers, training, promotion, and discipline of personnel.

### *Of Managerial Accounting*

Managerial accounting is the system of standards, orders, records, and reports through which managerial planning and control are implemented. A simple description of a chronological sequence such as given for the traditional accounting is difficult. Much is relatively permanent. Often several lines of development are occurring simultaneously, proceeding from various origins and effecting complex patterns of junctures. Much of the chronological pattern has been re-

viewed under Methods of Managerial Planning and Methods of Managerial Control above. Here the standards, orders, records, and reports involved will be briefly outlined.

### I. Physical Standards

#### A. Materials standards (from engineering department)

1. Specifications showing qualities
  - a. Composition
  - b. Dimensions and tolerances
  - c. Colors and finishes
  - d. Other physical or chemical properties
2. Bills of materials showing quantities

#### B. Labor standards

1. Job descriptions, analysis, and labor grades (from personnel department)
2. Standard times (from methods department)
  - a. Setup
  - b. Operating

#### C. Operations standards (from methods department)

1. Operation sheets showing
  - a. Operation sequences and routing
  - b. Machines and equipment
  - c. Fixtures and tooling
  - d. Gauges
2. Standard practice instructions for each operation showing
  - a. Work layout
  - b. Motion patterns

#### D. Burden standards

1. Maintenance schedules
  - a. Machinery: oiling, overhaul
  - b. Building: sweeping, painting, window washing
2. Services: heating, lighting, power, ventilation, air, water, steam
3. Personnel requirements: lockers, toilets, cafeteria, first aid, recreational aids, etc.

### II. Orders

#### A. Budgets

1. Sales estimates by items converted into
  2. Production releases by adjustments for
  3. Inventory requirements
  4. Plant and equipment
  5. Personnel activities
  6. Purchasing activities
  7. Accounting activities
- } based on sales and production estimates

#### B. Shop orders based on production releases

1. Materials requisitions
2. Production schedules
3. Operation and move orders
4. Repair and salvage orders

## III. Shop Reports

## A. Materials

1. Issued from stock
2. On hand (inventory counts)
3. Spoilage (inspection reports)
4. Received
  - a. Raw materials and purchased parts
  - b. Completed parts
  - c. Finished products

## B. Labor

1. Time tickets: setup and operating times
2. Gate clock cards: absences and tardiness
3. Accident reports
4. Merit-rating reports

## C. Shipments

## IV. Records

## A. Materials

1. Comparative purchase price record
2. Balance of stores or perpetual inventory
3. Spoilage and yield records

## B. Labor

1. Personal efficiency records
2. Attendance and seniority records
3. Work history and merit-rating records

## C. Financial

1. Files of original evidences
2. Journals
3. Ledgers

## V. Executive Reports

## A. Materials

1. Spoilage and yield reports
2. Exceptions
  - a. Shortages and overages
  - b. Rejections
  - c. Delayed shipments
  - d. Price variations

## B. Labor

1. Daily efficiency reports
2. Severances and exit interviews
3. Transfers and promotions
4. Training
5. Grievances reported and settled

## C. Burden

1. Departmental burden control reports

*D. Appropriations*

1. Appropriations requested and approved
2. Expenditure and progress reports

*E. Financial*

- |   |   |  |
|---|---|--|
| <ol style="list-style-type: none"> <li>1. Balance sheet</li> <li>2. Income statement</li> <li>3. Analysis of surplus</li> </ol> | } | traditional and adjusted for changing prices |
|---|---|--|

*F. Special studies*

1. Proposed changes in policies
2. Technological alternatives
3. Impact of social changes

The outline is obviously not exhaustive. It does exhibit the variety and complexity of the system of standards, orders, records, and reports. It should be borne in mind that all these documents, records, and procedures are shot through with managerial classifications and evaluations. The basic classifications reflect the laws of income and cost behavior along the various dimensions of managerial problems and the individual responsibilities for performance. These basic data are evaluated and summated according to the calculus of increments and opportunities and according to the pyramid of increasing authority and widening jurisdiction.

## SUMMARY

*Managerial Accounting**Traditional Accounting**A. Orientation*

## Managerial problems of

1. Planning
2. Control

## Legal-financial problems of

1. Ownership and investment
2. Credit granting
3. Taxation and regulation
4. Prevention of error and fraud

*B. Premises*

## Classification by

1. Effect on alternate programs
2. Individual responsibilities

## Classification by

1. Real vs. nominal
2. Debit vs. credit
3. Objects

## Current market values

1. Replacement cost
2. Opportunity cost

## Historical valuations

1. "Conservatism"
2. Original cost

## Incremental computations

1. Quantity discounts
2. Overtime premiums
3. Qualitative differences
4. Fixed and sunk costs

## Proportional allocations to

1. Time periods
2. Departments
3. Jobs

*Managerial Accounting**Traditional Accounting*

## C. Methods

## Physical standards

1. Qualities and quantities
2. Labor, material, and burden
3. Production schedules
4. Innovation schedules

## Basic pecuniary history

1. Promises and executions
2. Homogeneous classes
3. Exclusion of allocations
4. Legal-financial supplement

## Managerial planning

1. Definition of alternatives
2. Uses of standards as building blocks
3. Calculus of increments and opportunities
4. Role of managerial judgment

## Managerial control

1. Recasting of selected plan according to patterns of responsibility
2. Use of standards to police at source
3. Weighting for importance and for responsibility

## Original evidences

1. Exchanges with other economic units
2. Internal transfers

## Journalizing

1. Analysis of transactions
2. Object, debit-credit classification
3. Historical, proportional valuations

## Posting to ledgers

1. Sorting into accounts
2. Trial balance verification

## Financial statements

1. Balance sheet
2. Income statement
3. Statement of surplus
4. Applications and sources of funds



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